EASA
European Aviation Safety Agency

PART-FCL

Annex I - Part FCL

Disclaimer

This version has been prepared by the Agency in order to provide stakeholders with an updated and easy-to-read publication. It has been prepared by combining the officially published texts of the corresponding regulations together with the Acceptable Means of Compliance and Guidance Material (including the amendments) adopted so far. However, this is not an official publication and the Agency accepts no liability for damage of any kind resulting from the risks inherent in the use of this document.

This document will be updated regularly if needed to take into account further amendments.

The format of this document has been adjusted in order to make it easier to read and for reference purposes. Readers are invited and encouraged to report to fcl.easa.europa.eu any perceived errors, or comments relating to this publication.

Consolidated version

Subpart	Version
Subpart A – General Requirements	V1, June 2016
Subpart B – LAPL	V1, June 2016
Subpart C – PPL, SPL and BPL	V1, June 2016
Subpart D – CPL	V1, June 2016
Subpart E – MPL	V1, June 2016
Subpart F - ATPL	V1, June 2016
Subpart G – Instrument Rating	V1, June 2016
Subpart H – Class and Type Ratings	V1, June 2016
Subpart I – Additional Rating	V1, June 2016
Subpart J – Instructors	V1, June 2016
Subpart K – Examiners	V1, June 2016
Appendices	V1, June 2016

Amendments

Commission Regulations (Implementing rules)

Regulation (EU)	Date
2016/539	07/04/2016
2015/445	17/03/2015
245/2014	13/03/2014
70/2014	27/01/2014
290/2012	30/03/2012
1178/2011	03/11/2011

EASA Decisions (AMC & GM)

Amendment	Date
Amdt 2	05/04/2016
Amdt 1	02/04/2014
Part-FCL	15/12/2011

SUBPART A - GENERAL REQUIREMENTS

FCL.001 Competent authority

For the purpose of this Part, the competent authority shall be an authority designated by the Member State to whom a person applies for the issue of pilot licences or associated ratings or certificates.

FCL.005 Scope

This Part establishes the requirements for the issue of pilot licences and associated ratings and certificates and the conditions of their validity and use.

GM1 FCL.005 Scope

INTERPRETATIVE MATERIAL

(a) Whenever licences, ratings, approvals or certificates are mentioned in Part-FCL, these are meant to be valid licences, ratings, approvals or certificates issued in accordance with Part-FCL. In all other cases, these documents are specified.

(b) Whenever a reference is made to Member States to mutual recognition of licences, ratings, approvals or certificates, this means a European Union Member State and states associated to the Agency in accordance with Article 55 of the Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008.

(c) Whenever ‘or’ is used as an inclusive ‘or’, it should be understood in the sense of ‘and/or’.

FCL.010 Definitions

For the purposes of this Part, the following definitions apply:

"Aerobatic flight" means an intentional manoeuvre involving an abrupt change in an aircraft’s attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight or for instruction for licences or ratings other than the aerobatic rating.

"Aeroplane" means an engine-driven fixed-wing aircraft heavier than air which is supported in flight by the dynamic reaction of the air against its wings.

"Aeroplane required to be operated with a co-pilot" means a type of aeroplane which is required to be operated with a co-pilot as specified in the flight manual or by the air operator certificate.

"Aircraft" means any machine which can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface.

"Airmanship" means the consistent use of good judgement and well-developed knowledge, skills and attitudes to accomplish flight objectives.

"Airship" means a power-driven lighter-than-air aircraft, with the exception of hot-air airships, which, for the purposes of this Part, are included in the definition of balloon.

“Angular operation” means an instrument approach operation in which the maximum tolerable error/deviation from the planned track is expressed in terms of deflection of the needles on the Course Deviation Indicator (CDI) or equivalent display in the cockpit.

"Balloon" means a lighter-than-air aircraft which is not engine-driven and sustains flight through the use of either gas or an airborne heater. For the purposes of this Part, a hot-air airship, although engine-driven, is also considered a balloon.

"Basic Instrument Training Device" (BITD) means a ground-based training device which represents the student pilot’s station of a class of aeroplanes. It may use screen-based instrument panels and spring-loaded flight controls, providing a training platform for at least the procedural aspects of instrument flight.

"Category of aircraft" means a categorisation of aircraft according to specified basic characteristics, for example aeroplane, powered-lift, helicopter, airship, sailplane, free balloon.

"Class of aeroplane" means a categorisation of single-pilot aeroplanes not requiring a type rating.

"Class of balloon" means a categorisation of balloons taking into account the lifting means used to sustain flight.

"Commercial air transport" means the transport of passengers, cargo or mail for remuneration or hire.

"Competency" means a combination of skills, knowledge and attitude required to perform a task to the prescribed standard.

"Competency element" means an action which constitutes a task that has a triggering event and a terminating event that clearly defines its limits, and an observable outcome.

"Competency unit" means a discrete function consisting of a number of competency elements.

"Co-pilot" means a pilot operating other than as pilot-in-command, on an aircraft for which more than one pilot is required, but excluding a pilot who is on board the aircraft for the sole purpose of receiving flight instruction for a licence or rating.

"Cross-country" means a flight between a point of departure and a point of arrival following a pre-planned route, using standard navigation procedures.

"Cruise relief co-pilot" means a pilot who relieves the co-pilot of his/her duties at the controls during the cruise phase of a flight in multi-pilot operations above FL 200.

"Dual instruction time" means flight time or instrument ground time during which a person is receiving flight instruction from a properly authorised instructor.

"Error" means an action or inaction taken by the flight crew which leads to deviations from organisational or flight intentions or expectations.

"Error management" means the process of detecting and responding to errors with countermeasures which reduce or eliminate the consequences of errors, and mitigate the probability of errors or undesired aircraft states.

"Full Flight Simulator" (FFS) means a full size replica of a specific type or make, model and series aircraft flight deck, including the assemblage of all equipment and computer programmes necessary to represent the aircraft in ground and flight operations, a visual system providing an out-of-the-flight deck view, and a force cueing motion system.

"Flight time":
for aeroplanes, touring motor gliders and powered-lift, it means the total time from the moment an aircraft first moves for the purpose of taking off until the moment it finally comes to rest at the end of the flight;
for helicopters, it means the total time from the moment a helicopter's rotor blades start turning until the moment the helicopter finally comes to rest at the end of the flight, and the rotor blades are stopped;
for airships, it means the total time from the moment an airship is released from the mast for the purpose of taking off until the moment the airship finally comes to rest at the end of the flight, and is secured on the mast;
for sailplanes, it means the total time from the moment the sailplane commences the ground run in the process of taking off until the moment the sailplane finally comes to a rest at the end of flight;
for balloons, it means the total time from the moment the basket leaves the ground for the purpose of taking off until the moment it finally comes to a rest at the end of the flight.

"Flight time under Instrument Flight Rules" (IFR) means all flight time during which the aircraft is being operated under the Instrument Flight Rules.

"Flight Training Device" (FTD) means a full size replica of a specific aircraft type's instruments, equipment, panels and controls in an open flight deck area or an enclosed aircraft flight deck, including the assemblage of equipment and computer software programmes necessary to represent the aircraft in ground and flight conditions to the extent of the systems installed in the device. It does not require a force cueing motion or visual system, except in the case of helicopter FTD levels 2 and 3, where visual systems are required.

"Flight and Navigation Procedures Trainer" (FNPT) means a training device which represents the flight deck or cockpit environment, including the assemblage of equipment and computer programmes necessary to represent an aircraft type or class in flight operations to the extent that the systems appear to function as in an aircraft.

"Group of balloons" means a categorisation of balloons, taking into account the size or capacity of the envelope.

"Helicopter" means a heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

"Instrument flight time" means the time during which a pilot is controlling an aircraft in flight solely by reference to instruments.

"Instrument ground time" means the time during which a pilot is receiving instruction in simulated instrument flight, in flight simulation training devices (FSTD).

"Instrument time" means instrument flight time or instrument ground time.

“Linear operation” means an instrument approach operation in which the maximum tolerable error/deviation from the planned track is expressed in units of length, for instance nautical miles, for cross-track lateral deviation.

“LNAV” means Lateral Navigation.

“LPV” means Localiser Performance with Vertical Guidance.

"Multi-pilot operation":
for aeroplanes, it means an operation requiring at least 2 pilots using multi-crew cooperation in either multi-pilot or single-pilot aeroplanes;
for helicopters, it means an operation requiring at least 2 pilots using multi-crew cooperation on multi-pilot helicopters.

"Multi-crew cooperation" (MCC) means the functioning of the flight crew as a team of cooperating members led by the pilot-in-command.

"Multi-pilot aircraft":
for aeroplanes, it means aeroplanes certificated for operation with a minimum crew of at least two pilots;
for helicopters, airships and powered-lift aircraft, it means the type of aircraft which is required to be operated with a co-pilot as specified in the flight manual or by the air operator certificate or equivalent document.

"Night" means the period between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be prescribed by the appropriate authority, as defined by the Member State.

"Other training devices" (OTD) means training aids other than flight simulators, flight training devices or flight and navigation procedures trainers which provide means for training where a complete flight deck environment is not necessary.

“Performance-Based Navigation (PBN)” means area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

"Performance criteria" means a simple, evaluative statement on the required outcome of the competency element and a description of the criteria used to judge if the required level of performance has been achieved.

"Pilot-in-command" (PIC) means the pilot designated as being in command and charged with the safe conduct of the flight.

"Pilot-in-command under supervision" (PICUS) means a co-pilot performing, under the supervision of the pilot-in-command, the duties and functions of a pilot-in-command.

"Powered-lift aircraft" means any aircraft deriving vertical lift and in flight propulsion/lift from variable geometry rotors or engines/propulsive devices attached to or contained within the fuselage or wings.

"Powered sailplane" means an aircraft equipped with one or more engines having, with engines inoperative, the characteristics of a sailplane.

"Private pilot" means a pilot who holds a licence which prohibits the piloting of aircraft in operations for which remuneration is given, with the exclusion of instruction or examination activities, as established in this Part.

"Proficiency check" means the demonstration of skill to revalidate or renew ratings, and including such oral examination as may be required.

"Renewal" (of, e.g. a rating or certificate) means the administrative action taken after a rating or certificate has lapsed for the purpose of renewing the privileges of the rating or certificate for a further specified period consequent upon the fulfilment of specified requirements.

"Revalidation" (of, e.g. a rating or certificate) means the administrative action taken within the period of validity of a rating or certificate which allows the holder to continue to exercise the privileges of a rating or certificate for a further specified period consequent upon the fulfilment of specified requirements.

“RNP APCH” means a PBN specification used for instrument approach operations.

“RNP APCH operation down to LNAV minima” means a 2D instrument approach operation for which the lateral guidance is based on GNSS positioning.

“RNP APCH operation down to LNAV/VNAV minima” means a 3D instrument approach operation for which the lateral guidance is based on GNSS positioning and the vertical guidance is provided either by the Baro VNAV function or by the GNSS positioning including SBAS.

“RNP APCH operation down to LPV minima” means a 3D instrument approach operation for which both lateral and vertical guidance are based on GNSS positioning including SBAS.

“RNP AR APCH” means a navigation specification used for instrument approach operations requiring a specific approval.

"Route sector" means a flight comprising take-off, departure, cruise of not less than 15 minutes, arrival, approach and landing phases.

"Sailplane" means a heavier-than-air aircraft which is supported in flight by the dynamic reaction of the air against its fixed lifting surfaces, the free flight of which does not depend on an engine.

"Single-pilot aircraft" means an aircraft certificated for operation by one pilot.

"Skill test" means the demonstration of skill for a licence or rating issue, including such oral examination as may be required.

"Solo flight time" means flight time during which a student pilot is the sole occupant of an aircraft.

"Student pilot-in-command" (SPIC) means a student pilot acting as pilot-in-command on a flight with an instructor where the latter will only observe the student pilot and shall not influence or control the flight of the aircraft.

"Threat" means events or errors which occur beyond the influence of the flight crew, increase operational complexity and which must be managed to maintain the margin of safety.

"Threat management" means the process of detecting and responding to the threats with countermeasures which reduce or eliminate the consequences of threats, and mitigate the probability of errors or undesired aircraft states.

“Three-dimensional (3D) instrument approach operation” means an instrument approach operation using both lateral and vertical navigation guidance.

"Touring Motor Glider" (TMG) means a specific class of powered sailplane having an integrally mounted, non-retractable engine and a non-retractable propeller. It shall be capable of taking off and climbing under its own power according to its flight manual.

"Two-dimensional (2D) instrument approach operation" means an instrument approach operation using lateral navigation guidance only.

"Type of aircraft" means a categorisation of aircraft requiring a type rating as determined in the operational suitability data established in accordance with Part-21, and which include all aircraft of the same basic design including all modifications thereto except those which result in a change in handling or flight characteristics.

"VNAV" means Vertical Navigation.

GM1 FCL.010 Definitions

ABBREVIATIONS

The following abbreviations apply to the Acceptable Means of Compliance and Guidance Material to Part-FCL:

A	Aeroplane
AC	Alternating Current
ACAS	Airborne Collision Avoidance System
ADF	Automatic Direction Finding
ADS	Aeronautical Design Standard
AFCS	Automatic Flight Control System
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information regulation and control
AIS	Aeronautical Information Services
AMC	Acceptable Means of Compliance
AeMC	Aero-medical Centre
AME	Aero-medical Examiner
AOM	Aircraft Operating Manual
APU	Auxiliary Power Unit
As	Airship
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Approved Training Organisation
ATP	Airline Transport Pilot
ATPL	Airline Transport Pilot Licence
ATS	Air Traffic Service
AUM	All Up Mass
B	Balloon
BCAR	British Civil Airworthiness Requirement
BEM	Basic Empty Mass
BITD	Basic Instrument Training Device

BPL Balloon Pilot Licence

CAS Calibrated Air Speed
CAT Clear Air Turbulence
CB-IR Competency-based training course for instrument rating
CDI Course Deviation Indicator
CFI Chief Flying Instructor
CG Centre of Gravity
CGI Chief Ground Instructor
CP Co-pilot
CPL Commercial Pilot Licence
CRE Class Rating Examiner
CRI Class Rating Instructor
CRM Crew Resource Management
CS Certification Specification
CQB Central Question Bank

DC Direct Current
DF Direction Finding
DME Distance Measuring Equipment
DPATO Defined Point After Take-off
DPBL Defined Point Before Landing
DR Dead Reckoning navigation

EFIS Electronic Flight Instrument System
EIR En route instrument rating
EOL Engine Off Landings
ERPM Engine Revolution Per Minute
ETA Estimated Time of Arrival
ETOPS Extended-range Twin-engine Operation Performance Standard FAF Final Approach Fix

FAR Federal Aviation Regulations
FCL Flight Crew Licensing
FE Flight Examiner
F/E Flight Engineer
FEM Flight Examiner Manual
FFS Full Flight Simulator
FI Flight Instructor
FIE Flight Instructor Examiner
FIS Flight Information Service
FMC Flight Management Computer
FMS Flight Management System
FNPT Flight and Navigation Procedures Trainer
FS Flight Simulator
FSTD Flight Simulation Training Device
ft feet
FTD Flight Training Device

G Gravity forces
GLONASS Global Orbiting Navigation Satellite System

GM	Guidance Material
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
H	Helicopter
HF	High Frequency
HOFCS	High Order Flight Control System
HPA	High Performance Aeroplane
hrs	Hours
HUMS	Health and Usage Monitoring System
HT	Head of Training
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organisation
IGE	In Ground Effect
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IR	Instrument Rating
IRE	Instrument Rating Examiner
IRI	Instrument Rating Instructor
ISA	International Standard Atmosphere
JAR	Joint Aviation Requirements
kg	Kilogram
LAPL	Light Aircraft Pilot Licence
LDP	Landing Decision Point
LMT	Local Mean Time
LO	Learning Objectives
LOFT	Line Orientated Flight Training
m	Meter
MCC	Multi-Crew Cooperation
MCCI	Multi-Crew Cooperation Instructor
ME	Multi-engine
MEL	Minimum Equipment List
MEP	Multi-engine Piston
MET	Multi-engine Turboprop
METAR	Meteorological Aerodrome Report
MI	Mountain Rating Instructor
MP	Multi-pilot
MPA	Multi-pilot Aeroplane
MPL	Multi-crew Pilot Licence
MPH	Multi-pilot Helicopter
MTOM	Maximum Take-off Mass
NDB	Non-directional Beacon
NM	Nautical Miles
NOTAM	Notice To Airmen

NOTAR	No Tail Rotor
OAT	Outside Air Temperature
OBS	Omni Bearing Selector
OEI	One Engine Inoperative
OGE	Out of Ground Effect
OML	Operational Multi-pilot Limitation
OSL	Operational Safety Pilot Limitation
OTD	Other Training Devices
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot-In-Command
PICUS	Pilot-In-Command Under Supervision
PL	Powered-lift
PNF	Pilot Not Flying
PPL	Private Pilot Licence
QDM	Magnetic heading
QFE	Atmospheric pressure at aerodrome elevation
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RNAV	Radio Navigation
RPM	Revolution Per Minute
RRPM	Rotor Revolution Per Minute
R/T	Radiotelephony
S	Sailplane
SATCOM	Satellite communication
SE	Single-engine
SEP	Single-engine Piston
SET	Single-engine Turboprop
SFE	Synthetic Flight Examiner
SFI	Synthetic Flight Instructor
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Weather
SLPC	Single Lever Power Control
SOP	Standard Operating Procedure
SP	Single-pilot
SPA	Single-pilot Aeroplane
SPH	Single-pilot Helicopter
SPIC	Student PIC
SPL	Sailplane Pilot Licence
SSR	Secondary Surveillance Radar
STI	Synthetic Training Instructor
TAF	(Terminal Area Forecasts) Aerodrome Forecast
TAS	True Air Speed
TAWS	Terrain Awareness Warning System
TDP	Take-off Decision Point
TEM	Threat and Error Management

TK	Theoretical knowledge
TMG	Touring Motor Glider
TORA	Take-off Run Available
TODA	Take-off Distance Available
TR	Type Rating
TRE	Type Rating Examiner
TRI	Type Rating Instructor
UTC	Coordinated Universal Time
V	Velocity
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omni-directional Radio Range
ZFTT	Zero Flight Time Training
ZFM	Zero Fuel Mass

GM2 FCL.010 Definitions — lateral and vertical navigation

Lateral and vertical navigation guidance refers to the guidance provided either by:

(a) a ground-based radio navigation aid; or

(b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these

FCL.015 Application and issue, revalidation and renewal of licences, ratings and certificates

(a) An application for the issue, revalidation or renewal of pilot licences and associated ratings and certificates shall be submitted to the competent authority in a form and manner established by this authority. The application shall be accompanied by evidence that the applicant complies with the requirements for the issue, revalidation or renewal of the licence or certificate as well as associated ratings or endorsements, established in this Part and Part-Medical.

(b) Any limitation or extension of the privileges granted by a licence, rating or certificate shall be endorsed in the licence or certificate by the competent authority.

(c) A person shall not hold at any time more than one licence per category of aircraft issued in accordance with this Part.

(d) An application for the issue of a licence for another category of aircraft, or for the issue of further ratings or certificates, as well as an amendment, revalidation or renewal of those licences, ratings or certificates shall be submitted to the competent authority which initially issued the pilot licence, except when the pilot has requested a change of competent authority and a transfer of his licensing and medical records to that authority.

AMC1 FCL.015 Application and issue of licences, ratings and certificates

APPLICATION AND REPORT FORMS

Common application and report forms can be found:

(a) For skill tests, proficiency checks for issue, revalidation or renewal of LAPL, BPL, SPL, PPL, CPL and IR in AMC1 to Appendix 7.

(b) For training, skill tests or proficiency checks for ATPL, MPL and class and type ratings, in AMC1 to Appendix 9.

(c) For assessments of competence for instructors, in AMC5 FCL.935.

FCL.020 Student pilot

(a) A student pilot shall not fly solo unless authorised to do so and supervised by a flight instructor.

(b) Before his/her first solo flight, a student pilot shall be at least:

(1) in the case of aeroplanes, helicopters and airships: 16 years of age;

(2) in the case of sailplanes and balloons: 14 years of age.

FCL.025 Theoretical knowledge examinations for the issue of licences and ratings

(a) Responsibilities of the applicant

(1) Applicants shall take the entire set of theoretical knowledge examinations for a specific licence or rating under the responsibility of one Member State.

(2) Applicants shall only take the theoretical knowledge examination when recommended by the approved training organisation (ATO) responsible for their training, once they have completed the appropriate elements of the training course of theoretical knowledge instruction to a satisfactory standard.

(3) The recommendation by an ATO shall be valid for 12 months. If the applicant has failed to attempt at least one theoretical knowledge examination paper within this period of validity, the need for further training shall be determined by the ATO, based on the needs of the applicant.

(b) Pass standards

(1) A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. There is no penalty marking.

(2) Unless otherwise determined in this Part, an applicant has successfully completed the required theoretical knowledge examination for the appropriate pilot licence or rating when he/she has passed all the required examination papers within a period of 18 months counted from the end of the calendar month when the applicant first attempted an examination.

(3) If an applicant has failed to pass one of the theoretical knowledge examination papers within 4 attempts, or has failed to pass all papers within either 6 sittings or the period mentioned in paragraph (2), he/she shall re-take the complete set of examination papers.

Before re-taking the theoretical knowledge examinations, the applicant shall undertake further training at an ATO. The extent and scope of the training needed shall be determined by the ATO, based on the needs of the applicant.

(c) *Validity period*

(1) The successful completion of the theoretical knowledge examinations will be valid:

(i) for the issue of a light aircraft pilot licence, a private pilot licence, a sailplane pilot licence or a balloon pilot licence, for a period of 24 months;

(ii) for the issue of a commercial pilot licence, instrument rating (IR) or en route instrument rating (EIR), for a period of 36 months;

(iii) the periods in (i) and (ii) shall be counted from the day when the pilot successfully completes the theoretical knowledge examination, in accordance with (b)(2).

(2) The completion of the airline transport pilot licence (ATPL) theoretical knowledge examinations will remain valid for the issue of an ATPL for a period of 7 years from the last validity date of:

(i) an IR entered in the licence; or

(ii) in the case of helicopters, a helicopter's type rating entered in that licence.

AMC1 FCL.025 Theoretical knowledge examinations for the issue of licences

TERMINOLOGY

The meaning of the following terms used in FCL.025 should be as follows:

(a) 'Entire set of examinations': an examination in all subjects required by the licence level.

(b) 'Examination': the demonstration of knowledge in one or more examination papers.

(c) 'Examination paper': a set of questions to be answered by a candidate for examination.

(d) 'Attempt': a try to pass a specific paper.

(e) 'Sitting': a period of time established by the competent authority within which a candidate can take an examination. This period should not exceed 10 consecutive days. Only one attempt at each examination paper is allowed in one sitting.

FCL.030 Practical skill test

(a) Before a skill test for the issue of a licence, rating or certificate is taken, the applicant shall have passed the required theoretical knowledge examination, except in the case of applicants undergoing a course of integrated flying training.
In any case, the theoretical knowledge instruction shall always have been completed before the skill tests are taken.

(b) Except for the issue of an airline transport pilot licence, the applicant for a skill test shall be recommended for the test by the organisation/person responsible for the training, once the training is completed. The training records shall be made available to the examiner.

FCL.035 Crediting of flight time and theoretical knowledge

(a) *Crediting of flight time*

(1) Unless otherwise specified in this Part, flight time to be credited for a licence, rating or certificate shall have been flown in the same category of aircraft for which the licence, rating or certificate is sought.

(2) PIC or under instruction.

(i) An applicant for a licence, rating or certificate shall be credited in full with all solo, dual instruction or PIC flight time towards the total flight time required for the licence, rating or certificate.

(ii) A graduate of an ATP integrated training course is entitled to be credited with up to 50 hours of student pilot-in-command instrument time towards the PIC time required for the issue of the airline transport pilot licence, commercial pilot licence and a multi-engine type or class rating.

(iii) A graduate of a CPL/IR integrated training course is entitled to be credited with up to 50 hours of the student pilot-in-command instrument time towards the PIC time required for the issue of the commercial pilot licence and a multi-engine type or class rating.

(3) Flight time as co-pilot or PICUS. Unless otherwise determined in this Part, the holder of a pilot licence, when acting as co-pilot or PICUS, is entitled to be credited with all of the co-pilot time towards the total flight time required for a higher grade of pilot licence.

(b) *Crediting of theoretical knowledge*

(1) An applicant having passed the theoretical knowledge examination for an airline transport pilot licence shall be credited with the theoretical knowledge requirements for the light aircraft pilot licence, the private pilot licence, the commercial pilot licence and, except in the case of helicopters, the IR and the EIR in the same category of aircraft.

(2) An applicant having passed the theoretical knowledge examination for a commercial pilot licence shall be credited with the theoretical knowledge requirement for a light aircraft pilot licence or a private pilot licence in the same category of aircraft.

(3) The holder of an IR or an applicant having passed the instrument theoretical knowledge examination for a category of aircraft shall be fully credited towards the requirements for the theoretical knowledge instruction and examination for an IR in another category of aircraft.

(4) The holder of a pilot licence shall be credited towards the requirements for theoretical knowledge instruction and examination for a licence in another category of aircraft in accordance with Appendix 1 to this Part.

(5) Notwithstanding point (b)(3), the holder of an IR(A) who has completed a competency-based modular IR(A) course or the holder of an EIR shall only be credited in full towards the requirements for theoretical knowledge instruction and examination for an IR in another category of aircraft when also having passed the theoretical knowledge instruction and examination for the IFR part of the course required in accordance with FCL.720.A.(b)(2)(i).

This credit also applies to applicants for a pilot licence who have already successfully completed the theoretical knowledge examinations for the issue of that licence in another category of aircraft, as long as it is within the validity period specified in FCL.025(c).

FCL.040 Exercise of the privileges of licences

The exercise of the privileges granted by a licence shall be dependent upon the validity of the ratings contained therein, if applicable, and of the medical certificate.

FCL.045 Obligation to carry and present documents

(a) A valid licence and a valid medical certificate shall always be carried by the pilot when exercising the privileges of the licence.

(b) The pilot shall also carry a personal identification document containing his/her photo.

(c) A pilot or a student pilot shall without undue delay present his/her flight time record for inspection upon request by an authorised representative of a competent authority.

(d) A student pilot shall carry on all solo cross-country flights evidence of the authorisation required by FCL.020(a).

FCL.050 Recording of flight time

The pilot shall keep a reliable record of the details of all flights flown in a form and manner established by the competent authority.

AMC1 FCL.050 Recording of flight time

GENERAL

(a) The record of the flights flown should contain at least the following information:

(1) personal details: name(s) and address of the pilot;

(2) for each flight:

(i) name(s) of PIC;

(ii) date of flight;

(iii) place and time of departure and arrival;

(iv) type, including make, model and variant, and registration of the aircraft;

(v) indication if the aircraft is SE or ME, if applicable;

(vi) total time of flight;

(vii) accumulated total time of flight.

(3) for each FSTD session, if applicable:

(i) type and qualification number of the training device;

(ii) FSTD instruction;

(iii) date;

(iv) total time of session;

(v) accumulated total time.

(4) details on pilot function, namely PIC, including solo, SPIC and PICUS time, co-pilot, dual, FI or FE;

(5) Operational conditions, namely if the operation takes place at night, or is conducted under instrument flight rules.

(b) Logging of time:

(1) PIC flight time:

(i) the holder of a licence may log as PIC time all of the flight time during which he or she is the PIC;

(ii) the applicant for or the holder of a pilot licence may log as PIC time all solo flight time, flight time as SPIC and flight time under supervision provided that such SPIC time and flight time under supervision are countersigned by the instructor;

(iii) the holder of an instructor certificate may log as PIC all flight time during which he or she acts as an instructor in an aircraft;

(iv) the holder of an examiner's certificate may log as PIC all flight time during which he or she occupies a pilot's seat and acts as an examiner in an aircraft;

(v) a co-pilot acting as PICUS on an aircraft on which more than one pilot is required under the type certification of the aircraft or as required by operational requirements provided that such PICUS time is countersigned by the PIC;

(vi) if the holder of a licence carries out a number of flights upon the same day returning on each occasion to the same place of departure and the interval between successive flights does not exceed 30 minutes, such series of flights may be recorded as a single entry.

(2) co-pilot flight time: the holder of a pilot licence occupying a pilot seat as co-pilot may log all flight time as co-pilot flight time on an aircraft on which more than one pilot is required under the type certification of the aircraft, or the regulations under which the flight is conducted;

(3) cruise relief co-pilot flight time: a cruise relief co-pilot may log all flight time as co-pilot when occupying a pilot's seat;

(4) instruction time: a summary of all time logged by an applicant for a licence or rating as flight instruction, instrument flight instruction, instrument ground time, etc., may be logged if certified by the appropriately rated or authorised instructor from whom it was received;

(5) PICUS flight time: provided that the method of supervision is acceptable to the competent authority, a co-pilot may log as PIC flight time flown as PICUS when all the duties and functions of PIC on that flight were carried out in such a way that the intervention of the PIC in the interest of safety was not required.

(c) Format of the record:

(1) details of flights flown under commercial air transport may be recorded in a computerised format maintained by the operator. In this case an operator should make the records of all flights operated by the pilot, including differences and familiarisation training, available upon request to the flight crew member concerned;

(2) for other types of flight, the pilot should record the details of the flights flown in the following logbook format. For sailplanes and balloons, a suitable format should be used that contains the relevant items mentioned in (a) and additional information specific to the type of operation.

PILOT LOGBOOK

Holder's name(s) ___________________________________

Holder's licence number ___________________________________

<table>
<tr><td colspan="2">HOLDER'S ADDRESS:</td></tr>
<tr><td>______________________________
____
______________________________</td><td>______________________________
____
____
[space for address change]</td></tr>
<tr><td>______________________________
____
____
[space for address change]</td><td>______________________________
____
____
[space for address change]</td></tr>
<tr><td>______________________________
____
____
[space for address change]</td><td>______________________________
____
____
[space for address change]</td></tr>
</table>

1	2		3		4		5				6		7	8	
DATE (dd/mm/yy)	DEPARTURE		ARRIVAL		AIRCRAFT		SINGLE-PILOT TIME		MULTI-PILOT TIME		TOTAL TIME OF FLIGHT		NAME(S) PIC	LANDINGS	
	PLACE	TIME	PLACE	TIME	MAKE, MODEL, VARIANT	REGISTRATION	SE	ME						DAY	NIGHT
						TOTAL THIS PAGE									
						TOTAL FROM PREVIOUS PAGES									
						TOTAL TIME									

9				10								11				12
operational condition TIME				PILOT FUNCTION TIME								FSTD SESSION				REMARKS AND ENDORSEMENTS
NIGHT		IFR		PIC		CO-PILOT		DUAL		INSTRUCTOR		DATE (dd/mm/yy)	TYPE	TOTAL TIME OF SESSION		
																I certify that the entries in this log are true.
																PILOT'S SIGNATURE

INSTRUCTIONS FOR USE

(d) FCL.050 requires holders of a pilot licence to record details of all flights flown. This logbook enables pilot licence holders to record flying experience in a manner which will facilitate this process while providing a permanent record of the licence holders flying. Pilots who fly regularly aeroplanes and helicopters or other aircraft categories are recommended to maintain separate logbooks for each aircraft category.

(e) Flight crew logbook entries should be made as soon as practicable after any flight undertaken. All entries in the logbook should be made in ink or indelible pencil.

(f) The particulars of every flight in the course of which the holder of a flight crew licence acts as a member of the operating crew of an aircraft are to be recorded in the appropriate columns using one line for each flight, provided that if an aircraft carries out a number of flights upon the same day returning on each occasion to the same place of departure and the interval between successive flights does not exceed 30 minutes, such series of flights may be recorded as a single entry.

(g) Flight time is recorded:

(1) for aeroplanes, touring motor gliders and powered-lift aircraft, from the moment an aircraft first moves to taking off until the moment it finally comes to rest at the end of the flight;

(2) for helicopters, from the moment a helicopter's rotor blades start turning until the moment the helicopter finally comes to rest at the end of the flight, and the rotor blades are stopped;

(3) for airships, from the moment an airship is released from the mast to taking off until the moment the airship finally comes to rest at the end of the flight, and is secured on the mast;

(h) When an aircraft carries two or more pilots as members of the operating crew, one of them shall, before the flight commences, be designated by the operator as the aircraft PIC, according to operational requirements, who may delegate the conduct of the flight to another suitably qualified pilot. All flying carried out as PIC is entered in the logbook as 'PIC'. A pilot flying as 'PICUS' or 'SPIC' enters flying time as 'PIC' but all such entries are to be certified by the PIC or FI in the 'Remarks' column of the logbook.

(i) Notes on recording of flight time:

(1) column 1: enter the date (dd/mm/yy) on which the flight commences;

(2) column 2 or 3: enter the place of departure and destination either in full or the internationally recognised three or four letter designator. All times should be in UTC;

(3) column 5: indicate whether the operation was SP or MP, and for SP operation whether SE or ME;

Example:

1	2		3		4		5				6		7	8	
DATE (dd/mm/yy)	DEPARTURE		ARRIVAL		AIRCRAFT		SINGLE PILOT TIME		MULTI-PILOT TIME		TOTAL TIME OF FLIGHT		NAME(S) PIC	LANDINGS	
	PLACE	TIME	PLACE	TIME	MAKE, MODEL, VARIANT	REGISTRATION	SE	ME						DAY	NIGHT
08/04/12	LFAC	1025	EGBJ	1240	PA34-250	G-SENE		✓			2	15	SELF	1	
09/04/12	EGBJ	1810	EGBJ	1930	C152	G-NONE	✓				1	20	SELF		2
11/04/12	LGW	1645	LAX	0225	B747-400	G-ABCD			9	40	9	40	NAME(S) PIC		1

(4) column 6: total time of flight may be entered in hours and minutes or decimal notation as desired;

(5) column 7: enter the name(s) of PIC or SELF as appropriate;

(6) column 8: indicate the number of landings as pilot flying by day or night;

(7) column 9: enter flight time undertaken at night or under instrument flight rules if applicable;

(8) column 10: pilot function time:

(i) enter flight time as PIC, SPIC and PICUS as PIC;

(ii) all time recorded as SPIC or PICUS is countersigned by the aircraft PIC/FI in the 'remarks' (column 12);

(iii) instructor time should be recorded as appropriate and also entered as PIC.

(9) column 11: FSTD:

(i) for any FSTD enter the type of aircraft and qualification number of the device. For other flight training devices enter either FNPT I or FNPT II as appropriate;

(ii) total time of session includes all exercises carried out in the device, including pre- and after-flight checks;

(iii) enter the type of exercise performed in the 'remarks' (column 12), for example operator proficiency check, revalidation.

(10) column 12: the 'remarks' column may be used to record details of the flight at the holder's discretion. The following entries, however, should always be made:

(i) instrument flight time undertaken as part of the training for a licence or rating;

(ii) details of all skill tests and proficiency checks;

(iii) signature of PIC if the pilot is recording flight time as SPIC or PICUS;

(iv) signature of instructor if flight is part of an SEP or TMG class rating revalidation.

(j) When each page is completed, accumulated flight time or hours should be entered in the appropriate columns and certified by the pilot in the 'remarks' column.

Example:

9				10								11				12
operational condition TIME				PILOT FUNCTION TIME								FSTD SESSION				REMARKS AND ENDORSEMENTS
NIGHT		IFR		PIC		CO-PILOT		DUAL		INSTRUCTOR		DATE (dd/mm/yy)	TYPE	TOTAL TIME OF SESSION		
		2	15	2	15											
1	20			1	20					1	20					Night rating training
												10/04/12	B747-400 (Q1234)	4	10	Revalidation proficiency check
8	10	9	40	9	40											PIC(US): signature of NAME(S) PIC

FCL.055 Language proficiency

(a) General. Aeroplane, helicopter, powered-lift and airship pilots required to use the radio telephone shall not exercise the privileges of their licences and ratings unless they have a language proficiency endorsement on their licence in either English or the language used for radio communications involved in the flight. The endorsement shall indicate the language, the proficiency level and the validity date.

(b) The applicant for a language proficiency endorsement shall demonstrate, in accordance with Appendix 2 to this Part, at least an operational level of language proficiency both in the use of phraseologies and plain language. To do so, the applicant shall demonstrate the ability to:

(1) communicate effectively in voice-only and in face-to-face situations;

(2) communicate on common and work-related topics with accuracy and clarity;

(3) use appropriate communicative strategies to exchange messages and to recognise and resolve misunderstandings in a general or work-related context;

(4) handle successfully the linguistic challenges presented by a complication or unexpected turn of events which occurs within the context of a routine work situation or communicative task with which they are otherwise familiar; and

(5) use a dialect or accent which is intelligible to the aeronautical community.

(c) Except for pilots who have demonstrated language proficiency at an expert level, in accordance with Appendix 2 to this Part, the language proficiency endorsement shall be re-evaluated every:

(1) 4 years, if the level demonstrated is operational level; or

(2) 6 years, if the level demonstrated is extended level.

(d) Specific requirements for holders of an instrument rating (IR) or en-route instrument rating (EIR). Without prejudice to the paragraphs above, holders of an IR or an EIR shall have demonstrated the ability to use the English language at a level which allows them to:

(1) understand all the information relevant to the accomplishment of all phases of a flight, including flight preparation;

(2) use radio telephony in all phases of flight, including emergency situations;

(3) communicate with other crew members during all phases of flight, including flight preparation.

(e) The demonstration of language proficiency and the use of English for IR or EIR holders shall be done through a method of assessment established by the competent authority.

AMC1 FCL.055 Language proficiency

GENERAL

(a) The language proficiency assessment should be designed to reflect a range of tasks undertaken by pilots but with specific focus on language rather than operational procedures.

(b) The assessment should determine the applicant's ability to:

(1) communicate effectively using standard R/T phraseology;

(2) deliver and understand messages in plain language in both usual and unusual situations that necessitate departure from standard R/T phraseology.

Note: refer to the 'Manual on the Implementation of ICAO Language Proficiency Requirements' (ICAO Doc 9835), Appendix A Part III and Appendix B for further guidance.

ASSESSMENT

(c) The assessment may be subdivided into three elements, as follows:

(1) listening: assessment of comprehension;

(2) speaking: assessment of pronunciation, fluency, structure and vocabulary;

(3) interaction.

(d) The three elements mentioned above may be combined and they can be covered by using a wide variety of means or technologies.

(e) Where appropriate, some or all of these elements may be achieved through the use of the R/T testing arrangements.

(f) When the elements of the testing are assessed separately, the final assessment should be consolidated in the language proficiency endorsement issued by the competent authority.

(g) The assessment may be conducted during one of the several existing checking or training activities, such as licence issue or rating issue and revalidation, line training, operator line checks or proficiency checks.

(h) The competent authority may use its own resources in developing or conducting the language proficiency assessment, or may delegate this task to language assessment bodies.

(i) The competent authority should establish an appeal procedure for applicants.

(j) The holder of a licence should receive a statement containing the level and validity of the language endorsements.

(k) Where the assessment method for the English language established by the competent authority is equivalent to that established for the assessment of use of the English language in accordance with AMC2 FCL.055, the same assessment may be used for both purposes.

BASIC ASSESSMENT REQUIREMENTS

(l) The aim of the assessment is to determine the ability of an applicant for a pilot licence or a licence holder to speak and understand the language used for R/T communications.

(1) The assessment should determine the ability of the applicant to use both:

(i) standard R/T phraseology;

(ii) plain language, in situations when standardised phraseology cannot serve an intended transmission.

(2) The assessment should include:

(i) voice-only or face-to-face situations;

(ii) common, concrete and work-related topics for pilots.

(3) The applicants should demonstrate their linguistic ability in dealing with an unexpected turn of events, and in solving apparent misunderstandings.

(4) The assessment should determine the applicant's speaking and listening abilities. Indirect assessments, of grammatical knowledge, reading and writing, are not appropriate.

(5) The assessment should determine the language skills of the applicant in the following areas:

(i) pronunciation:

(A) the extent to which the pronunciation, stress, rhythm and intonation are influenced by the applicant's first language or national variations;

(B) how much they interfere with ease of understanding.

(ii) structure:

(A) the ability of the applicant to use both basic and complex grammatical structures;

(B) the extent to which the applicant's errors interfere with the meaning.

(iii) vocabulary:

(A) the range and accuracy of the vocabulary used;

(B) the ability of the applicant to paraphrase successfully when lacking vocabulary.

(iv) fluency:

(A) tempo;

(B) hesitancy;

(C) rehearsed versus spontaneous speech;

(D) use of discourse markers and connectors.

(v) comprehension:

(A) on common, concrete and work-related topics;

(B) when confronted with a linguistic or situational complication or an unexpected turn of events.

Note: the accent or variety of accents used in the test material should be sufficiently intelligible for an international community of users.

(vi) interactions:

(A) quality of response (immediate, appropriate, and informative);

(B) the ability to initiate and maintain exchanges:

(a) on common, concrete and work-related topics;

(b) when dealing with an unexpected turn of events.

(C) the ability to deal with apparent misunderstandings by checking, confirming or clarifying.

Note: the assessment of the language skills in the areas mentioned above is conducted using the rating scale in AMC2 FCL.055.

(6) When the assessment is not conducted in a face-to-face situation, it should use appropriate technologies for the assessment of the applicant's abilities in listening and speaking, and for enabling interactions (for example: simulated pilot or controller communication).

ASSESSORS

(m) It is essential that the persons responsible for language proficiency assessment ('assessors') are suitably trained and qualified. They should be either aviation specialists (for example current or former flight crew members or air traffic controllers), or language specialists with additional aviation-related training. An alternative approach would be to form an assessment team consisting of an operational expert and a language expert.

(1) The assessors should be trained on the specific requirements of the assessment.

(2) The assessors should not test applicants to whom they have given language training.

CRITERIA FOR THE ACCEPTABILITY OF LANGUAGE ASSESSMENT BODIES

(n) To ensure an impartial assessment process, the language assessment should be independent of the language training.

(1) To be accepted, the language assessment bodies should demonstrate:

(i) appropriate management and staffing;

(ii) quality system established and maintained to ensure compliance with, and adequacy of, assessment requirements, standards and procedures.

(2) The quality system established by a language assessment body should address the following:

(i) management;

(ii) policy and strategy;

(iii) processes;

(iv) the relevant provisions of ICAO or Part-FCL, standards and assessment procedures;

(v) organisational structure;

(vi) responsibility for the development, establishment and management of the quality system;

(vii) documentation;

(viii) quality assurance programme;

(ix) human resources and training (initial and recurrent);

(x) assessment requirements;

(xi) customer satisfaction.

(3) The assessment documentation and records should be kept for a period of time determined by the competent authority and made available to this competent authority, on request.

(4) The assessment documentation should include at least the following:

(i) assessment objectives;

(ii) assessment layout, time scale, technologies used, assessment samples, voice samples;

(iii) assessment criteria and standards (at least for the levels 4, 5 and 6 of the rating scale mentioned in AMC2 FCL.055);

(iv) documentation demonstrating the assessment validity, relevance and reliability;

(v) assessment procedures and responsibilities:

(A) preparation of individual assessment;

(B) administration: location(s), identity check and invigilation, assessment discipline, confidentiality or security;

(C) reporting and documentation provided to the competent authority or to the applicant, including sample certificate;

(D) retention of documents and records.

Note: refer to the 'Manual on the Implementation of ICAO Language Proficiency Requirements' (ICAO Doc 9835) for further guidance.

AMC2 FCL.055 Language proficiency

RATING SCALE

The following table describes the different levels of language proficiency:

LEVEL	PRONUNCIATION	STRUCTURE	VOCABULARY	FLUENCY	COMPREHENSION	INTERACTIONS
	Assumes a dialect or accent intelligible to the aeronautical community	*Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*				
Expert (Level 6)	Pronunciation, stress, rhythm, and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced and sensitive to register.	Able to speak at length with a natural, effortless flow. Varies speech flow for stylistic effect, for example to emphasise a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and non-verbal cues, and responds to them appropriately.
Extended (Level 5)	Pronunciation, stress, rhythm, and intonation, though influenced by the first language or regional variation, rarely interfere with	Basic grammatical structures and sentence patterns are consistently well controlled. Complex structures are attempted but with errors which	Vocabulary range and accuracy are sufficient to communicate effectively on common, concrete, and work-related topics. Paraphrases	Able to speak at length with relative ease on familiar topics, but may not vary speech flow as a stylistic device. Can make use of appropriate	Comprehension is accurate on common, concrete, and work-related topics and mostly accurate when the speaker is confronted with a	Responses are immediate, appropriate, and informative. Manages the speaker or listener relationship effectively.

LEVEL	***PRONUNCIATION***	***STRUCTURE***	***VOCABULARY***	***FLUENCY***	***COMPREHENSION***	***INTERACTIONS***
	Assumes a dialect or accent intelligible to the aeronautical community	*Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*				
	ease of understanding.	sometimes interfere with meaning.	consistently and successfully. Vocabulary is sometimes idiomatic.	discourse markers or connectors.	linguistic or situational complication or an unexpected turn of events. Is able to comprehend a range of speech varieties (dialect or accent) or registers.	
Operatio-nal **(Level 4)**	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning.	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics. Can often paraphrase successfully when lacking vocabulary particularly in unusual or unexpected circumstances.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers and	Comprehension is mostly accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming, or clarifying.

LEVEL	*PRONUNCIATION*	*STRUCTURE*	*VOCABULARY*	*FLUENCY*	*COMPREHENSION*	*INTERACTIONS*
	Assumes a dialect or accent intelligible to the aeronautical community	*Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*				
				connectors. Fillers are not distracting.	events, comprehension may be slower or require clarification strategies.	
Pre-Operatio-nal (Level 3)	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns associated with predictable situations are not always well controlled. Errors frequently interfere with meaning.	Vocabulary range and accuracy are often sufficient to communicate effectively on common, concrete, and work-related topics but range is limited and the word choice often inappropriate. Is often unable to paraphrase successfully when lacking vocabulary.	Produces stretches of language, but phrasing and pausing are often inappropriate. Hesitations or slowness in language processing may prevent effective communication. Fillers are sometimes distracting.	Comprehension is often accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. May fall to understand a linguistic or situational complication or an unexpected turn of events.	Responses are sometimes immediate, appropriate, and informative. Can initiate and maintain exchanges with reasonable ease on familiar topics and in predictable situations. Generally inadequate when dealing with an unexpected turn of events.
Elemen-tary (Level 2)	Pronunciation, stress, rhythm, and intonation are heavily influenced	Shows only limited control of few simple memorised grammatical	Limited vocabulary range consisting only of isolated	Can produce very short, isolated, memorised utterances with	Comprehension is limited to isolated, memorised phrases when they are	Response time is slow, and often inappropriate. Interaction is limited to simple routine exchanges.

LEVEL	***PRONUNCIATION***	***STRUCTURE***	***VOCABULARY***	***FLUENCY***	***COMPREHENSION***	***INTERACTIONS***
	Assumes a dialect or accent intelligible to the aeronautical community	*Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*				
	by the first language or regional variation and usually interfere with ease of understanding.	structures and sentence patterns.	words and memorised phrases.	frequent pausing and a distracting use of fillers to search for expressions and articulate less familiar words.	carefully and slowly articulated.	
Pre-Elemen-tary (Level 1)	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.

Note: operational Level (Level 4) is the minimum required proficiency level for R/T communication.

Levels 1 through 3 describe pre-elementary, elementary and pre-operational levels of language proficiency respectively, all of which describe a level below the language proficiency requirement.

Levels 5 and 6 describe extended and expert levels at levels of proficiency more advanced than the minimum required standard.

AMC3 FCL.055 Language proficiency

SPECIFIC REQUIREMENTS FOR HOLDERS OF AN IR

USE OF ENGLISH LANGUAGE

(a) The requirement of FCL.055(d) includes the ability to use the English language for the following purposes:

(1) flight: R/T relevant to all phases of flight, including emergency situations.

(2) ground: all information relevant to the accomplishment of a flight:

(i) be able to read and demonstrate an understanding of technical manuals written in English, for example an operations manual, a helicopter flight manual, etc.;

(ii) pre-flight planning, weather information collection, NOTAMs, ATC flight plan, etc.;

(iii) use of all aeronautical en-route, departure and approach charts and associated documents written in English.

(3) communication: be able to communicate with other crew members in English during all phases of flight, including flight preparation.

(b) Alternatively, the items in (a) above may be demonstrated:

(1) by having passed a specific examination given by the competent authority after having undertaken a course of training enabling the applicant to meet all the objectives listed in (a) above; or

(2) the item in (a)(1) above is considered to be fulfilled, if the applicant has passed an IR, MPL or ATPL skill test and proficiency check during which the two-way R/T communication is performed in English;

(3) the item in (a)(2) above is considered to be fulfilled if the applicant has graduated from an IR, MPL or ATP course given in English or if he or she has passed the theoretical IR or ATPL examination in English;

(4) the item in (a)(3) above is considered to be fulfilled, if the applicant for or the holder of an IR has graduated from an MCC course given in English and is holding a certificate of satisfactory completion of that course or if the applicant has passed a MP skill test and proficiency check for the issue of a class or type rating during which the two-way R/T communication and the communication with other crew members are performed in English.

(c) Where the examination methods referred to above are equivalent to those established for the language proficiency requirements in accordance with AMC1 FCL.055, the examination may be used to issue a language proficiency endorsement.

FCL.060 Recent experience

(a) Balloons. A pilot shall not operate a balloon in commercial air transport or carrying passengers unless he/she has completed in the preceding 180 days:

(1) at least 3 flights as a pilot flying in a balloon, of which at least 1 shall be in a balloon of the relevant class and group; or

(2) 1 flight in the relevant class and group of balloon under the supervision of an instructor qualified in accordance with Subpart J.

(b) Aeroplanes, helicopters, powered-lift, airships and sailplanes. A pilot shall not operate an aircraft in commercial air transport or carrying passengers:

(1) as PIC or co-pilot unless he/she has carried out, in the preceding 90 days, at least 3 take-offs, approaches and landings in an aircraft of the same type or class or an FFS representing that type or class. The 3 take-offs and landings shall be performed in either multi-pilot or single-pilot operations, depending on the privileges held by the pilot; and

(2) as PIC at night unless he/she:

(i) has carried out in the preceding 90 days at least 1 take-off, approach and landing at night as a pilot flying in an aircraft of the same type or class or an FFS representing that type or class; or

(ii) holds an IR;

(3) as cruise relief co-pilot unless he/she:

(i) has complied with the requirements in (b)(1); or

(ii) has carried out in the preceding 90 days at least 3 sectors as a cruise relief pilot on the same type or class of aircraft; or

(iii) has carried out recency and refresher flying skill training in an FFS at intervals not exceeding 90 days. This refresher training may be combined with the operator's refresher training prescribed in the relevant requirements of Part-ORO.

(4) When a pilot has the privilege to operate more than one type of aeroplane with similar handling and operation characteristics, the 3 take-offs, approaches and landings required in (1) may be performed as defined in the operational suitability data established in accordance with Part-21.

(5) When a pilot has the privilege to operate more than one type of non- complex helicopter with similar handling and operation characteristics, as defined in the operational suitability data established in accordance with Part-21, the 3 take-offs, approaches and landings required in (1) may be performed in just one of the types, provided that the pilot has completed at least 2 hours of flight in each of the types of helicopter, during the preceding 6 months.

(c) Specific requirements for commercial air transport:

(1) In the case of commercial air transport, the 90-day period prescribed in subparagraphs (b)(1) and (2) above may be extended up to a maximum of 120 days, as long as the pilot undertakes line flying under the supervision of a type rating instructor or examiner.

(2) When the pilot does not comply with the requirement in (1), he/she shall complete a training flight in the aircraft or an FFS of the aircraft type to be used, which shall include at

least the requirements described in (b)(1) and (2) before he/she can exercise his/her privileges.

AMC1 FCL.060(b)(1) Recent experience

When a pilot needs to carry out one or more flights with an instructor or an examiner to comply with the requirement of FCL.060(b)(1) before the pilot can carry passengers, the instructor or examiner on board those flights will not be considered as a passenger.

GM1 FCL.060(b)(1) Recent experience

AEROPLANES, HELICOPTERS, POWERED-LIFT, AIRSHIPS AND SAILPLANES

If a pilot or a PIC is operating under the supervision of an instructor to comply with the required three take-offs, approaches and landings, no passengers may be on board.

AMC1 FCL.060(b)(5) Recent experience

NON-COMPLEX HELICOPTERS

Grouping of non-complex helicopters with similar handling and operational characteristics:

(a) Group 1: Bell 206/206L, Bell 407;

(b) Group 2: Hughes 369, MD 500N, MD 520N, MD 600;

(c) Group 3: SA 341/342, EC 120;

(d) Group 4: SA 313/318, SA 315/316/319, AS 350, EC 130;

(e) Group 5: all types listed in AMC1 FCL.740.H (a)(3) and R 22 and R 44.

FCL.065 Curtailment of privileges of licence holders aged 60 years or more in commercial air transport

(a) Age 60-64. Aeroplanes and helicopters. The holder of a pilot licence who has attained the age of 60 years shall not act as a pilot of an aircraft engaged in commercial air transport except as a member of a multi-pilot crew.

(b) Age 65. Except in the case of a holder of a balloon or sailplane pilot licence, the holder of a pilot licence who has attained the age of 65 years shall not act as a pilot of an aircraft engaged in commercial air transport.

(c) Age 70. The holder of a balloon or sailplane pilot licence who has attained the age of 70 years shall not act as a pilot of a balloon or a sailplane engaged in commercial air transport.

FCL.070 Revocation, suspension and limitation of licences, ratings and certificates

(a) Licences, ratings and certificates issued in accordance with this Part may be limited, suspended or revoked by the competent authority when the pilot does not comply with the requirements of this

Part, Part-Medical or the applicable operational requirements, in accordance with the conditions and procedures laid down in Part-ARA.

(b) When the pilot has his/her licence suspended or revoked, he/she shall immediately return the licence or certificate to the competent authority.

SUBPART B - LIGHT AIRCRAFT PILOT LICENCE — LAPL

SECTION 1 - Common requirements

FCL.100 LAPL — Minimum age

Applicants for the LAPL shall be:

(a) in the case of aeroplanes and helicopters, at least 17 years of age;

(b) in the case of sailplanes and balloons, at least 16 years of age.

FCL.105 LAPL — Privileges and conditions

(a) General. The privileges of the holder of an LAPL are to act without remuneration as PIC in non-commercial operations on the appropriate aircraft category.

(b) Conditions. Applicants for the LAPL shall have fulfilled the requirements for the relevant aircraft category and, when applicable, for the class or type of aircraft used in the skill test.

FCL.110 LAPL — Crediting for the same aircraft category

(a) Applicants for an LAPL who have held another licence in the same category of aircraft shall be fully credited towards the requirements of the LAPL in that category of aircraft.

(b) Without prejudice to the paragraph above, if the licence has lapsed, the applicant shall have to pass a skill test in accordance with FCL.125 for the issue of an LAPL in the appropriate aircraft category.

FCL.115 LAPL — Training course

Applicants for an LAPL shall complete a training course within an ATO. The course shall include theoretical knowledge and flight instruction appropriate to the privileges given.

AMC1 FCL.115; FCL.120

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE LAPL

(a) The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated with the licence and the activity. The theoretical knowledge instruction provided by the ATO should include a certain element of formal classroom work but may also include other methods of delivery for example interactive video, slide or tape presentation, computer-based training and other media distance learning courses. The training organisation responsible for the training has to check if all the appropriate elements of the training course of theoretical knowledge instruction have been completed to a satisfactory standard before recommending the applicant for the examination.

(b) The following tables contain the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the LAPL(B) and LAPL(S). The syllabi for the theoretical knowledge instruction and examination for the PPL(A) and PPL(H) in AMC1 FCL.210 and FCL.215 should be used for the LAPL(A) and the LAPL(H), respectively.

I. COMMON SUBJECTS

[FOR LAPL(S) AND LAPL(B)]

1.	**AIR LAW AND ATC PROCEDURES**
1.1.	International law: conventions, agreements and organisations
1.2.	Airworthiness of aircraft
1.3.	Aircraft nationality and registration marks
1.4.	Personnel licensing
1.5.	Rules of the air
1.6.	Procedures for air navigation: aircraft operations
1.7.	Air traffic regulations: airspace structure
1.8.	ATS and air traffic management
1.9.	AIS
1.10.	Aerodromes, external take-off sites
1.11.	Search and rescue
1.12.	Security
1.13.	Accident reporting
1.14.	National law
2.	**HUMAN PERFORMANCE**
2.1.	Human factors: basic concepts
2.2.	Basic aviation physiology and health maintenance
2.3.	Basic aviation psychology
3.	**METEOROLOGY**
3.1.	The atmosphere
3.2.	Wind
3.3.	Thermodynamics
3.4.	Clouds and fog
3.5.	Precipitation
3.6.	Air masses and fronts

3.7	Pressure systems
3.8.	Climatology
3.9.	Flight hazards
3.10.	Meteorological information
4.	**COMMUNICATIONS**
4.1.	VFR communications
4.2.	Definitions
4.3.	General operating procedures
4.4.	Relevant weather information terms (VFR)
4.5.	Action required to be taken in case of communication failure
4.6.	Distress and urgency procedures
4.7.	General principles of VHF propagation and allocation of frequencies

II. ADDITIONAL SUBJECTS FOR EACH CATEGORY

II.A. SAILPLANES

5.	**PRINCIPLES OF FLIGHT - SAILPLANE**
5.1.	Aerodynamics (airflow)
5.2.	Flight mechanics
5.3.	Stability
5.4.	Control
5.5.	Limitations (load factor and manoeuvres)
5.6.	Stalling and spinning
6.	**OPERATIONAL PROCEDURES - SAILPLANE**
6.1.	General requirements
6.2.	Launch methods
6.3.	Soaring techniques
6.4.	Circuits and landing
6.5.	Outlanding
6.6.	Special operational procedures and hazards
6.7.	Emergency procedures

Go back to Subpart B
Go back to the content

7.	**FLIGHT PERFORMANCE AND PLANNING - SAILPLANE**
7.1.	Verifying mass and balance
7.2.	Speed polar of sailplanes or cruising speed
7.3.	Flight planning and task setting
7.4.	ICAO flight plan (ATS flight plan)
7.5.	Flight monitoring and in-flight re-planning
8.	**AIRCRAFT GENERAL KNOWLEDGE, AIRFRAME AND SYSTEMS AND EMERGENCY EQUIPMENT – SAILPLANE**
8.1.	Airframe
8.2.	System design, loads and stresses
8.3.	Landing gear, wheels, tyres and brakes
8.4.	Mass and balance
8.5.	Flight controls
8.6.	Instruments
8.7.	Manuals and documents
8.8.	Airworthiness and maintenance
9.	**NAVIGATION – SAILPLANE**
9.1.	Basics of navigation
9.2.	Magnetism and compasses
9.3.	Charts
9.4.	Dead reckoning navigation
9.5.	In-flight navigation
9.6.	Global navigation satellite systems

II.B. BALLOONS

5.	**PRINCIPLES OF FLIGHT – BALLOON**
5.1.	Principles of flight
5.2.	Aerostatics
5.3.	Loading limitations
5.4.	Operational limitations
6.	**OPERATIONAL PROCEDURES – BALLOON**

6.1.	General requirements
6.2.	Special operational procedures and hazards (general aspects)
6.3.	Emergency procedures
7.	**FLIGHT PERFORMANCE AND PLANNING – BALLOON**
7.1.	Mass
7.1.1.	Purpose of mass considerations
7.1.2.	Loading
7.2.	Performance
7.2.1.	Performance: general
7.3.	Flight planning and flight monitoring
7.3.1.	Flight planning: general
7.3.2.	Fuel planning
7.3.3.	Pre-flight preparation
7.3.4.	ICAO flight plan (ATS flight plan)
7.3.5.	Flight monitoring and in-flight re-planning
8.	**AIRCRAFT GENERAL KNOWLEDGE, ENVELOPE AND SYSTEMS AND EMERGENCY EQUIPMENT – BALLOON**
8.1.	System design, loads, stresses and maintenance
8.2.	Envelope
8.3.	Burner (hot-air balloon and hot-air airship)
8.4.	Fuel cylinders (hot-air balloon or hot-air airship)
8.5.	Basket or gondola
8.6.	Lifting gas (gas balloon)
8.7.	Burning gas (hot-air balloon or hot-air airship)
8.8.	Ballast (gas balloon)
8.9.	Engine (hot-air airship only)
8.10.	Instruments
8.11.	Emergency equipment
9.	**NAVIGATION – BALLOON**
9.1.	General navigation

9.2.	Basics of navigation
9.3.	Magnetism and compasses
9.4.	Charts
9.5.	Dead reckoning navigation
9.6.	In-flight navigation
9.7.	GNSS

FCL.120 LAPL — Theoretical knowledge examination

Applicants for an LAPL shall demonstrate a level of theoretical knowledge appropriate to the privileges granted, through examinations on the following:

(a) common subjects:

— Air law,

— Human performance,

— Meteorology, and

— Communications;

(b) specific subjects concerning the different aircraft categories:

— Principles of flight,

— Operational procedures,

— Flight performance and planning,

— Aircraft general knowledge, and

— Navigation.

AMC1 FCL.115; FCL.120

AMC1 FCL.120; FCL.125

THEORETICAL KNOWLEDGE EXAMINATION AND SKILL TEST FOR THE LAPL

(a) Theoretical knowledge examination

(1) The examinations should be in written form and should comprise a total of 120 multiple-choice questions covering all the subjects.

(2) For the subject ‘communication’ practical classroom testing may be conducted.

(3) The competent authority should inform applicants of the language(s) in which the examinations will be conducted.

(b) Skill test

Further training may be required following any failed skill test or part thereof. There should be no limit to the number of skill tests that may be attempted.

(c) Conduct of the test

If the applicant chooses to terminate a skill test for reasons considered inadequate by the FE, the applicant should retake the entire skill test. If the test is terminated for reasons considered adequate by the FE, only those sections not completed should be tested in a further flight.

Any manoeuvre or procedure of the test may be repeated once by the applicant. The FE may stop the test at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest.

An applicant should be required to fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

FCL.125 LAPL — Skill test

(a) Applicants for an LAPL shall demonstrate through the completion of a skill test the ability to perform, as PIC on the appropriate aircraft category, the relevant procedures and manoeuvres with competency appropriate to the privileges granted.

(b) Applicants for the skill test shall have received flight instruction on the same class or type of aircraft to be used for the skill test. The privileges will be restricted to the class or type used for the skill test until further extensions are endorsed on the licence, in accordance with this Subpart.

(c) Pass marks

(1) The skill test shall be divided into different sections, representing all the different phases of flight appropriate to the category of aircraft flown.

(2) Failure in any item of a section will cause the applicant to fail the entire section. If the applicant fails only 1 section, he/she shall repeat only that section. Failure in more than 1 section will cause the applicant to fail the entire test.

(3) When the test needs to be repeated in accordance with (2), failure in any section, including those that have been passed on a previous attempt, will cause the applicant to fail the entire test.

(4) Failure to achieve a pass in all sections of the test in 2 attempts will require further practical training.

AMC1 FCL.120; FCL.125

AMC1 FCL.125 LAPL — Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(A)

(a) The route to be flown for the skill test should be chosen by the FE. The route should end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should have a duration of at least 30 minutes which allows the pilot to demonstrate his/her ability to complete a route with at least two identified waypoints and may, as agreed between applicant and FE, be flown as a separate test.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the flight manual or the authorised checklist for the aeroplane or TMG on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane or TMG used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the aeroplane or TMG within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the aeroplane or TMG at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the aeroplane or TMG used:

(1) height:

normal flight ± 150 ft

(2) speed:

(i) take-off and approach +15/-5 knots

(ii) all other flight regimes ± 15 knots

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(A):

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE

Use of checklist, airmanship, control of aeroplane or TMG by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Pre-flight documentation, NOTAM and weather briefing
b	Mass and balance and performance calculation
c	Aeroplane or TMG inspection and servicing
d	Engine starting and after starting procedures
e	Taxiing and aerodrome procedures, pre-take-off procedures
f	Take-off and after take-off checks
g	Aerodrome departure procedures
h	ATC liaison: compliance
SECTION 2 GENERAL AIRWORK	
a	ATC liaison
b	Straight and level flight, with speed changes
c	Climbing: i. best rate of climb; ii. climbing turns; iii. levelling off.
d	Medium (30° bank) turns, look-out procedures and collision avoidance
e	Steep (45 ° bank) turns
f	Flight at critically low air speed with and without flaps

g	Stalling: i. clean stall and recover with power; ii. approach to stall descending turn with bank angle 20 °, approach configuration; iii. approach to stall in landing configuration.
h	Descending: i. with and without power; ii. descending turns (steep gliding turns); iii. levelling off.
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed
c	Orientation, airspace structure, timing and revision of ETAs, log keeping
d	Diversion to alternate aerodrome (planning and implementation)
e	Flight management (checks, fuel systems, carburettor icing, etc.)
f	ATC liaison: compliance
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures
b	Collision avoidance (look-out procedures)
c	Precision landing (short field landing) and crosswind, if suitable conditions available
d	Flapless landing (if applicable)
e	Approach to landing with idle power

f	Touch and go
g	Go-around from low height
h	ATC liaison
i	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with Sections 1 through 4	
a	Simulated engine failure after take-off
b	* Simulated forced landing
c	* Simulated precautionary landing
d	Simulated emergencies
e	Oral questions

* These items may be combined, at the discretion of the FE

AMC2 FCL.125 LAPL — Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(H)

(a) The area and route to be flown for the skill test should be chosen by the FE. The route should end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should consist of at least two legs, each leg of a minimum duration of 10 minutes. The skill test may be conducted in two flights.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the flight manual or the authorised checklist or pilot operating handbook for the helicopter on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the helicopter used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the helicopter within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the helicopter used:

(1) height:

(i) normal forward flight ± 150 ft

(ii) with simulated major emergency ± 200 ft

(iii) hovering IGE flight ± 2 ft

(2) speed:

(i) take-off approach +15 knots /-10 knots

(ii) all other flight regimes ± 15 knots

(3) round drift:

(i) take-off hover IGE ± 3 ft

(ii) landing no sideways or backwards movement

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(H):

SECTION 1 PRE-FLIGHT OR POST-FLIGHT CHECKS AND PROCEDURES	
Use of checklist, airmanship, control of helicopter by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Helicopter knowledge (for example technical log, fuel, mass and balance, performance), flight planning, NOTAM, and weather briefing
b	Pre-flight inspection or action, location of parts and purpose

c	Cockpit inspection, starting procedure
d	Communication and navigation equipment checks, selecting and setting frequencies
e	Pre-take-off procedure and ATC liaison
f	Parking, shutdown and post-flight procedure
SECTION 2 HOVER MANOEUVRES, ADVANCED HANDLING AND CONFINED AREAS	
a	Take-off and landing (lift off and touch down)
b	Taxi and hover taxi
c	Stationary hover with head, cross and tail wind
d	Stationary hover turns, 360 ° left and right (spot turns)
e	Forward, sideways and backwards hover manoeuvring
f	Simulated engine failure from the hover
g	Quick stops into and downwind
h	Sloping ground or unprepared sites landings and take-offs
i	Take-offs (various profiles)
j	Crosswind and downwind take-off (if practicable)
k	Take-off at maximum take-off mass (actual or simulated)
l	Approaches (various profiles)
m	Limited power take-off and landing
n	Autorotations (FE to select two items from the following: basic, range, low speed, and 360 ° turns)
o	Autorotative landing
p	Practice forced landing with power recovery

q	Power checks, reconnaissance technique, approach and departure technique
SECTION 3 NAVIGATION AND EN-ROUTE PROCEDURES	
a	Navigation and orientation at various altitudes or heights and map reading
b	Altitude or height, speed, heading control, observation of airspace and altimeter setting
c	Monitoring of flight progress, flight-log, fuel usage, endurance, ETA, assessment of track error, re-establishment of correct track and instrument monitoring
d	Observation of weather conditions and diversion planning
e	Collision avoidance (look-out procedures)
f	ATC liaison with due observance of regulations
SECTION 4 FLIGHT PROCEDURES AND MANOEUVRES	
a	Level flight, control of heading, altitude or height and speed
b	Climbing and descending turns to specified headings
c	Level turns with up to 30 ° bank, 180 ° to 360 ° left and right
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES (SIMULATED WHERE APPROPRIATE)	
Note: The FE selects 4 items from the following:	
a	Engine malfunctions, including governor failure, carburettor or engine icing and oil system, as appropriate
b	Fuel system malfunction
c	Electrical system malfunction
d	Hydraulic system malfunction, including approach and landing without hydraulics, as applicable
e	Main rotor or anti-torque system malfunction (FFS or discussion only)
f	Fire drills, including smoke control and removal, as applicable

g	Other abnormal and emergency procedures as outlined in appropriate flight manual

AMC1 FCL.125; FCL.235

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(S) AND OF AN SPL

(a) An applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) The applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the sailplane on which the test is being taken.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the sailplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the sailplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(S) and of an SPL:

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of checklist, airmanship (control of sailplane by external visual reference), look-out. Apply in all sections.	
a	Pre-flight sailplane (daily) inspection, documentation, NOTAM and weather briefing
b	Verifying in-limits mass and balance and performance calculation
c	Sailplane servicing compliance

d	Pre-take-off checks
SECTION 2 LAUNCH METHOD Note: at least for one of the three launch methods all the mentioned items are fully exercised during the skill test	
SECTION 2 (A) WINCH OR CAR LAUNCH	
a	Signals before and during launch, including messages to winch driver
b	Adequate profile of winch launch
c	Simulated launch failure
d	Situational awareness
SECTION 2 (B) AEROTOW LAUNCH	
a	Signals before and during launch, including signals to or communications with tow plane pilot for any problems
b	Initial roll and take-off climb
c	Launch abandonment (simulation only or ‘talk-through’)
d	Correct positioning during straight flight and turns
e	Out of position and recovery
f	Correct release from tow
g	Look-out and airmanship through whole launch phase
SECTION 2 (C) SELF-LAUNCH (powered sailplanes only)	
a	ATC compliance (if applicable)
b	Aerodrome departure procedures
c	Initial roll and take-off climb

d	Look-out and airmanship during the whole take-off
e	Simulated engine failure after take-off
f	Engine shut down and stowage
SECTION 3 GENERAL AIRWORK	
a	Maintain straight flight: attitude and speed control
b	Coordinated medium (30 ° bank) turns, look-out procedures and collision avoidance
c	Turning on to selected headings visually and with use of compass
d	Flight at high angle of attack (critically low air speed)
e	Clean stall and recovery
f	Spin avoidance and recovery
g	Steep (45 ° bank) turns, look-out procedures and collision avoidance
h	Local area navigation and awareness
SECTION 4 CIRCUIT, APPROACH AND LANDING	
a	Aerodrome circuit joining procedure
b	Collision avoidance: look-out procedures
c	Pre-landing checks
d	Circuit, approach control and landing
e	Precision landing (simulation of out-landing and short field)
f	Crosswind landing if suitable conditions available

AMC2 FCL.125; FCL.235

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(B) AND A BPL

(a) The take-off site should be chosen by the applicant depending on the actual meteorological conditions, the area which has to be over flown and the possible options for suitable landing sites. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the balloon on which the test is being taken. During pre-flight preparation for the test the applicant should be required to perform crew and passenger briefings and demonstrate crowd control. The load calculation should be performed by the applicant in compliance with the operations manual or flight manual for the balloon used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the balloon within its limitations;

(2) complete all manoeuvres with smoothness and accuracy

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the balloon at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The skill test contents and sections set out in this paragraph should be used for the skill test for the issue of a LAPL(B) (hot-air balloon) and a BPL (hot-air balloon):

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control, crew and passenger briefings
e	Assembly and layout
f	Inflation and pre-take-off procedures

g	Take-off
h	ATC compliance(if applicable)
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance (if applicable)
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation and airspace structure
d	Maintenance of altitude
e	Fuel management
f	Communication with retrieve crew
g	ATC compliance
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level, missed approach and fly on
b	Approach from high level, missed approach and fly on
c	Pre-landing checks
d	Passenger pre-landing briefing
e	Selection of landing field

f	Landing, dragging and deflation
g	ATC compliance (if applicable)
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
a	Simulated fire on the ground and in the air
b	Simulated pilot light and burner failures
c	Other abnormal and emergency procedures as outlined in the appropriate flight manual.
d	Oral questions

(e) The skill test contents and sections set out in this paragraph should be used for the skill test for the issue of a LAPL(B) (gas balloon) and a BPL (gas balloon):

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control, crew and passenger briefings
e	Assembly and layout
f	Inflation and pre-take-off procedures
g	Take-off
h	ATC compliance (if applicable)
SECTION 2 GENERAL AIRWORK	

a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance (if applicable)
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation and airspace structure
d	Maintenance of altitude
e	Ballast management
f	Communication with retrieve crew
g	ATC compliance
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level, missed approach and fly on
b	Approach from high level, missed approach and fly on
c	Pre-landing checks
d	Passenger pre-landing briefing
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance (if applicable)
h	Actions after flight

SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
a	Simulated closed appendix during take-off and climb
b	Simulated parachute or valve failure
c	Other abnormal and emergency procedures as outlined in the appropriate flight manual
d	Oral questions

Go back to Subpart B
Go back to the content

SECTION 2 - Specific requirements for the LAPL for aeroplanes — LAPL(A)

FCL.105.A LAPL(A) — Privileges and conditions

(a) The privileges of the holder of an LAPL for aeroplanes are to act as PIC on single-engine piston aeroplanes-land or TMG with a maximum certificated take-off mass of 2 000 kg or less, carrying a maximum of 3 passengers, such that there are never more than 4 persons on board of the aircraft.

(b) Holders of a LAPL(A) shall only carry passengers once they have completed 10 hours of flight time as PIC on aeroplanes or TMG after the issuance of the licence

FCL.110.A LAPL(A) — Experience requirements and crediting

(a) Applicants for an LAPL(A) shall have completed at least 30 hours of flight instruction on aeroplanes or TMGs, including at least:

(1) 15 hours of dual flight instruction in the class in which the skill test will be taken;

(2) 6 hours of supervised solo flight time, including at least 3 hours of solo cross-country flight time with at least 1 cross-country flight of at least 150 km (80 NM), during which 1 full stop landing at an aerodrome different from the aerodrome of departure shall be made.

(b) Specific requirements for applicants holding an LAPL(S) with TMG extension. Applicants for an LAPL(A) holding an LAPL(S) with TMG extension shall have completed at least 21 hours of flight time on TMGs after the endorsement of the TMG extension and complied with the requirements of FCL.135.A(a) on aeroplanes.

(c) Crediting. Applicants with prior experience as PIC may be credited towards the requirements in (a).

The amount of credit shall be decided by the ATO where the pilot undergoes the training course, on the basis of a pre-entry flight test, but shall in any case:

(1) not exceed the total flight time as PIC;

(2) not exceed 50 % of the hours required in (a);

(3) not include the requirements of (a)(2).

AMC1 FCL.110.A LAPL(A) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE LAPL (A)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL (A) flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including mass and balance determination, aircraft inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at critically low air speeds, recognition of, and recovery from, incipient and full stalls;

(v) flight at critically high air speeds, recognition of, and recovery from, spiral dive;

(vi) normal and crosswind take-offs and landings;

(vii) maximum performance (short field and obstacle clearance) take-offs, short-field landings;

(viii) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(ix) emergency operations, including simulated aeroplane equipment malfunctions;

(x) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the aeroplane or TMG type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the aeroplane or TMG:

(A) characteristics of the aeroplane or TMG;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and aeroplane or TMG acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) harness, seat or rudder panel adjustments;

(G) starting and warm-up checks;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing (for example tie down);

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects when laterally level and when banked;

(B) further effects of aileron and rudder;

(C) effects of:

(a) air speed;

(b) slipstream;

(c) power;

(d) trimming controls;

(e) flaps;

(f) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5a: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures.

(vii) Exercise 5b: Emergencies: brake and steering failure.

(viii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance, trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb, levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(x) Exercise 8: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(xi) Exercise 9: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (in correct pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) slipping turns (for suitable types);

(G) turns onto selected headings, use of gyro heading indicator and compass;

(H) use of instruments for precision.

(xii) Exercise 10a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the aeroplane or TMG in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xiii) Exercise 10b: Stalling:

(A) safety checks;

(B) symptoms;

(C) recognition;

(D) clean stall and recovery without power and with power;

(E) recovery when a wing drops;

(F) approach to stall in the approach and in the landing configurations, with and without power and recovery at the incipient stage.

(xiv) Exercise 11: Spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45°);

(C) instructor induced distractions during the stall.

(xv) Exercise 12: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel (if applicable);

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure or techniques including performance calculations;

(G) noise abatement procedures.

(xvi) Exercise 13: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel (if applicable);

(D) effect of wind on approach and touchdown speeds and use of flaps;

(E) crosswind approach and landing;

(F) glide approach and landing;

(G) short landing and soft field procedures or techniques;

(H) flapless approach and landing;

(I) wheel landing (tail wheel aeroplanes);

(J) missed approach and go-around;

(K) noise abatement procedures.

(xvii) Exercise 12/13: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety, it will be necessary for pilots trained on nose wheel aeroplanes or TMGs to undergo dual conversion training before flying tail wheel aeroplanes or TMGs, and vice versa.

(xviii) Exercise 14: First solo:

(A) instructor's briefing including limitations;

(B) use of required equipment;

(C) observation of flight and de-briefing by instructor.

Note: during flights immediately following the solo circuit consolidation the following should be revised:

(A) procedures for leaving and rejoining the circuit;

(B) the local area, restrictions, map reading;

(C) use of radio aids for homing;

(D) turns using magnetic compass, compass errors.

(xix) Exercise 15: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xx) Exercise 16: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine cooling;

(G) engine failure checks;

(H) use of radio;

(I) base leg;

(J) final approach;

(K) landing;

(L) actions after landing.

(xxi) Exercise 17: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating a precautionary landing;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xxii) Exercise 18a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) mass and performance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) aeroplane or TMG documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of altitude and heading;

(d) revisions of ETA and heading;

(e) log keeping;

(f) use of radio;

(g) minimum weather conditions for continuation of flight;

(h) in-flight decisions;

(i) transiting controlled or regulated airspace;

(j) diversion procedures;

(k) uncertainty of position procedure;

(l) lost procedure.

(C) arrival and aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of aeroplane or TMG;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xxiii) Exercise 18b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles, and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxiv) Exercise 18c: Radio navigation (basics):

(A) use of GNSS or VOR/ADF:

(a) selection of waypoints or stations;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(xxv) Exercise 19: Stopping and restarting the engine (in the case of TMGs only):

(A) engine cooling;

(B) switching-off procedure;

(C) restarting of the engine.

AMC2 FCL.110.A LAPL(A) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.A(c) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(A), in accordance with AMC1 FCL.110.A.

FCL.135.A LAPL(A) — Extension of privileges to another class or variant of aeroplane

(a) The privileges of an LAPL(A) shall be limited to the class and variant of aeroplanes or TMG in which the skill test was taken. This limitation may be removed when the pilot has completed in another class the requirements below:

(1) 3 hours of flight instruction, including:

(i) 10 dual take-offs and landings; and

(ii) 10 supervised solo take-offs and landings.

(2) a skill test to demonstrate an adequate level of practical skill in the new class. During this skill test, the applicant shall also demonstrate to the examiner an adequate level of theoretical knowledge for the other class in the following subjects:

(i) Operational procedures;

(ii) Flight performance and planning;

(iii) Aircraft general knowledge.

(b) Before the holder of an LAPL can exercise the privileges of the licence on another variant of aeroplane than the one used for the skill test, the pilot shall undertake differences or familiarisation training. The differences training shall be entered in the pilot's logbook or equivalent document and signed by the instructor.

GM1 FCL.135.A; FCL.135.H

DIFFERENCES AND FAMILIARISATION TRAINING

(a) Differences training requires the acquisition of additional knowledge and training on an appropriate training device or the aircraft.

(b) Familiarisation training requires the acquisition of additional knowledge.

FCL.140.A LAPL(A) — Recency requirements

(a) Holders of an LAPL(A) shall only exercise the privileges of their licence when they have completed, in the last 24 months, as pilots of aeroplanes or TMG:

(1) at least 12 hours of flight time as PIC, including 12 take-offs and landings; and

(2) refresher training of at least 1 hour of total flight time with an instructor.

(b) Holders of an LAPL(A) who do not comply with the requirements in (a) shall:

(1) undertake a proficiency check with an examiner before they resume the exercise of the privileges of their licence; or

(2) perform the additional flight time or take-offs and landings, flying dual or solo under the supervision of an instructor, in order to fulfil the requirements in (a).

SECTION 3 - Specific requirements for the LAPL for helicopters — LAPL(H)

FCL.105.H LAPL(H) — Privileges

The privileges of the holder of an LAPL for helicopters are to act as PIC on single-engine helicopters with a maximum certificated take-off mass of 2 000 kg or less, carrying a maximum of 3 passengers, such that there are never more than 4 persons on board.

FCL.110.H LAPL(H) — Experience requirements and crediting

(a) Applicants for the LAPL(H) shall have completed 40 hours of flight instruction on helicopters. At least 35 hours of which shall be flown on the type of helicopter that is to be used for the skill test. The flight instruction shall include at least:

(1) 20 hours of dual flight instruction; and

(2) 10 hours of supervised solo flight time, including at least 5 hours of solo cross-country flight time with at least 1 cross-country flight of at least 150 km (80 NM), during which one full stop landing at an aerodrome different from the aerodrome of departure shall be made.

(b) Crediting. Applicants with prior experience as PIC may be credited towards the requirements in (a).

The amount of credit shall be decided by the ATO where the pilot undergoes the training course, on the basis of a pre-entry flight test, but shall in any case:

(1) not exceed the total flight time as PIC;

(2) not exceed 50 % of the hours required in (a);

(3) not include the requirements in (a)(2).

AMC1 FCL.110.H LAPL(H) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE LAPL(H)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL(H) flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic autorotations, simulated engine failure and ground resonance recovery if relevant to type;

(vi) sideways and backwards flight and turns on the spot;

(vii) incipient vortex ring recognition and recovery;

(viii) touchdown autorotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(ix) steep turns;

(x) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(xi) limited power and confined area operations including selection of and operations to and from unprepared sites;

(xii) cross-country flying by using visual reference, dead reckoning and, where available and radio navigation aids;

(xiii) operations to and from aerodromes; compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant’s progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the helicopter type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the helicopter:

(A) characteristics of the helicopter, external features;

(B) cockpit layout;

(C) systems;

(D) checklists, procedures, controls.

(ii) Exercise 1b: Emergency procedures:

(A) action if fire on the ground and in the air;

(B) engine, cabin and electrical system fire;

(C) systems failures;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and helicopter acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) seat, harness and flight controls adjustments;

(G) starting and warm-up checks clutch engagement and starting rotors;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing;

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience:

(A) to introduce the student to rotary wing flight;

(B) flight exercise.

(v) Exercise 4: Effects of controls:

(A) function of flight controls, primary and secondary effect;

(B) effect of air speed;

(C) effect of power changes (torque);

(D) effect of yaw (sideslip);

(E) effect of disc loading (bank and flare);

(F) effect on controls of selecting hydraulics on/off;

(G) effect of control friction;

(H) instruments;

(I) use of carburettor heat or anti-icing control.

(vi) Exercise 5: Power and attitude changes:

(A) relationship between cyclic control position, disc attitude, fuselage attitude and air speed;

(B) flapback;

(C) power required diagram in relation to air speed;

(D) power and air speed changes in level flight;

(E) use of instruments for precision;

(F) engine and air speed limitations.

(vii) Exercise 6a: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) control in pitch, including use of control friction or trim;

(C) maintaining direction and balance, (ball or yawstring use);

(D) setting power for selected air speeds and speed changes;

(E) use of instruments for precision.

(viii) Exercise 6b: Climbing:

(A) optimum climb speed, best angle or rate of climb from power required diagram;

(B) initiation, maintaining the normal and maximum rate of climb, levelling off;

(C) levelling off at selected altitudes or heights;

(D) use of instruments for precision.

(ix) Exercise 6c: Descending:

(A) optimum descent speed and best angle or rate of descent from power required diagram;

(B) initiation, maintaining and levelling off;

(C) levelling off at selected altitudes or heights;

(D) descent (including effect of power and air speed);

(E) use of instruments for precision.

(x) Exercise 6d: Turning:

(A) initiation and maintaining medium level turns;

(B) resuming straight flight;

(C) altitude, bank and coordination;

(D) climbing and descending turns and effect on rate of climb or descent;

(E) turns onto selected headings, use of gyro heading indicator and compass;

(F) use of instruments for precision.

(xi) Exercise 7: Basic autorotation:

(A) safety checks, verbal warning and look-out;

(B) entry, development and characteristics;

(C) control of air speed and RRPM, rotor and engine limitations;

(D) effect of AUM, IAS, disc loading, G-forces and density altitude

(E) re-engagement and go-around procedures (throttle over-ride or ERPM control);

(F) vortex condition during recovery;

(G) gentle and medium turns in autorotation;

(H) demonstration of variable flare simulated engine off landing.

(xii) Exercise 8a: Hovering:

(A) demonstrate hover IGE, importance of wind effect and attitude, ground cushion, stability in the hover, effects of over controlling;

(B) student holding cyclic stick only;

(C) student handling collective lever (and throttle) only;

(D) student handling collective lever, (throttle) and pedals;

(E) student handling all controls;

(F) demonstration of ground effect;

(G) demonstration of wind effect;

(H) demonstrate gentle forward running touchdown;

(I) specific hazards, for example snow, dust and litter.

(xiii) Exercise 8b: Hover taxiing and spot turns:

(A) revise hovering;

(B) precise ground speed and height control;

(C) effect of wind direction on helicopter attitude and control margin;

(D) control and coordination during spot turns;

(E) carefully introduce gentle forward running touchdown.

(xiv) Exercise 8c: Hovering and taxiing emergencies:

(A) revise hovering and gentle forward running touchdown, explain (demonstrate where applicable) effect of hydraulics failure in the hover;

(B) demonstrate simulated engine failure in the hover and hover taxi.

(C) demonstrate dangers of mishandling and over-pitching.

(xv) Exercise 9: Take-off and landing

(A) pre-take-off checks or drills;

(B) look-out;

(C) lifting to hover;

(D) after take-off checks;

(E) danger of horizontal movement near ground;

(F) danger of mishandling and overpitching;

(G) landing (without sideways or backwards movement);

(H) after landing checks or drills;

(I) take-off and landing crosswind and downwind.

(xvi) Exercise 10: Transitions from hover to climb and approach to hover:

(A) look-out;

(B) revise take-off and landing;

(C) ground effect, translational lift and its effects;

(D) flapback and its effects;

(E) effect of wind speed and direction during transitions from or to the hover;

(F) the constant angle approach;

(G) demonstration of variable flare simulated engine off landing.

(xvii) Exercise 11a: Circuit, approach and landing:

(A) revise transitions from hover to climb and approach to hover;

(B) circuit procedures, downwind and base leg;

(C) approach and landing with power;

(D) pre-landing checks;

(E) effect of wind on approach and IGE hover

(F) crosswind approach and landing;

(G) go-around;

(H) noise abatement procedures.

(viii) Exercise 11b: Steep and limited power approaches and landings:

(A) revise the constant angle approach;

(B) the steep approach (explain danger of high sink rate and low air speed);

(C) limited power approach (explain danger of high speed at touch down);

(D) use of the ground effect;

(E) variable flare simulated engine off landing.

(xix) Exercise 11c: Emergency procedures:

(A) abandoned take-off;

(B) missed approach and go-around;

(C) hydraulic off landing (if applicable);

(D) tail rotor control or tail rotor drive failure (briefing only);

(E) simulated emergencies in the circuit to include:

(F) hydraulics failure;

(G) simulated engine failure on take-off, crosswind, downwind and base leg;

(H) governor failure.

(xx) Exercise 12: First solo:

(A) instructor's briefing, observation of flight and debriefing;

(B) warn of change of attitude from reduced and laterally displaced weight;

(C) warn of low tail, low skid or wheel during hover and landing;

(D) warn of dangers of loss of RRPM and overpitching;

(E) pre-take-off checks;

(F) into wind take-off;

(G) procedures during and after take-off;

(H) normal circuit, approaches and landings;

(I) action if an emergency.

(xxi) Exercise 13: Sideways and backwards hover manoeuvring:

(A) manoeuvring sideways flight heading into wind;

(B) manoeuvring backwards flight heading into wind;

(C) combination of sideways and backwards manoeuvring;

(D) manoeuvring sideways and backwards, heading out of wind;

(E) stability and weather cocking;

(F) recovery from backwards manoeuvring, (pitch nose down);

(G) groundspeed limitations for sideways and backwards manoeuvring.

(xxii) Exercise 14: Spot turns:

(A) revise hovering into wind and downwind;

(B) turn on spot through 360º:

(a) around pilots position;

(b) around tail rotor;

(c) around helicopter geometric centre;

(d) square and safe visibility clearing turn.

(C) rotor RPM control, torque effect, cyclic limiting stops due to CG position and wind speed and direction.

(xxiii) Exercise 15: Hover OGE and vortex ring:

(A) establishing hover OGE;

(B) drift, height or power control;

(C) demonstration of incipient stage of vortex ring, recognition and recovery (from a safe altitude);

(D) loss of tail rotor effectiveness.

(xxiv) Exercise 16: Simulated EOL:

(A) the effect of weight, disc loading, density attitude and RRPM decay;

(B) revise basic autorotation entry;

(C) optimum use of cyclic and collective to control speed or RRPM;

(D) variable flare simulated EOL;

(E) demonstrate constant attitude simulated EOL;

(F) demonstrate simulated EOL from hover or hover taxi;

(G) demonstrate simulated EOL from transition and low level.

(xxv) Exercise 17: Advanced autorotation:

(A) over a selected point at various height and speed;

(B) revise basic autorotation: note ground distance covered;

(C) range autorotation;

(D) low speed autorotation;

(E) constant attitude autorotation (terminate at safe altitude);

(F) 'S' turns;

(G) turns through 180° and 360°;

(H) effects on angles of descent, IAS, RRPM and effect of AUM.

(xxvi) Exercise 18: Practice forced landings:

(A) procedure and choice of the forced landing area;

(B) forced landing checks and crash action;

(C) re-engagement and go-around procedures.

(xxvii) Exercise 19: Steep turns:

(A) steep (level) turns (30° bank);

(B) maximum rate turns (45° bank if possible);

(C) steep autorotative turns;

(D) faults in the turn: balance, attitude, bank and coordination;

(E) RRPM control and disc loading;

(F) vibration and control feedback;

(G) effect of wind at low level.

(xxviii) Exercise 20: Transitions:

(A) revise ground effect, translational lift and flapback;

(B) maintaining constant height, (20–30 ft AGL):

(C) transition from hover to minimum 50 knots IAS and back to hover;

(D) demonstrate effect of wind.

(xxix) Exercise 21: Quick stops:

(A) use of power and controls;

(B) effect of wind;

(C) quick stops into wind;

(D) quick stops from crosswind and downwind terminating into wind;

(E) danger of vortex ring;

(F) danger of high disc loading.

(xxx) Exercise 22a: Navigation:

(A) Flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation and use:

(1) choice of route;

(2) controlled airspace, danger and prohibited areas;

(3) safety altitudes and noise abatement considerations.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate landing sites.

(e) helicopter documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form (where appropriate).

(B) Departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of height or altitude and heading;

(d) revisions of ETA and heading:

(1) 10° line, double track, track error and closing angle;

(2) 1 in 60 rule;

(3) amending an ETA.

(e) log keeping;

(f) use of radio;

(g) minimum weather conditions for continuation of flight;

(h) in-flight decisions;

(i) transiting controlled or regulated airspace;

(j) uncertainty of position procedure;

(k) lost procedure.

(C) Arrival and aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of helicopter;

(g) refuelling;

(h) closing of flight plan, (if appropriate);

(i) post-flight administrative procedures.

(xxxi) Exercise 22b: Navigation problems at low heights and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and other aircraft);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) avoidance of noise sensitive areas;

(F) joining the circuit;

(G) bad weather circuit and landing;

(H) appropriate procedures and choice of landing area for precautionary landings.

(xxxii) Exercise 22c: Radio navigation (basics):

(A) Use of GNNS or VOR/NDB:

(a) selection of waypoints;

(b) to or from indications or orientation;

(c) error messages.

(B) Use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) Use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(xxxiii) Exercise 23: Advanced take-off, landings and transitions:

(A) landing and take-off out of wind (performance reduction);

(B) ground effect, translational lift and directional stability variation when out of wind;

(C) downwind transitions;

(D) vertical take-off over obstacles;

(E) reconnaissance of landing site;

(F) running landing;

(G) zero speed landing;

(H) crosswind and downwind landings;

(I) steep approach;

(J) go-around.

(xxxiv) Exercise 24: Sloping ground:

(A) limitations and assessing slope angle;

(B) wind and slope relationship: blade and control stops;

(C) effect of CG when on slope;

(D) ground effect on slope and power required;

(E) right skid up slope;

(F) left skid up slope;

(G) nose up slope;

(H) avoidance of dynamic roll over, dangers soft ground and sideways movement on touchdown;

(I) danger of striking main or tail rotor by harsh control movement near ground.

(xxxv) Exercise 25: Limited power:

(A) take-off power check;

(B) vertical take-off over obstacles;

(C) in-flight power check;

(D) running landing;

(E) zero speed landing;

(F) approach to low hover;

(G) approach to hover;

(H) approach to hover OGE;

(I) steep approach;

(J) go-around.

(xxxvi) Exercise 26: Confined areas:

(A) landing capability and performance assessment;

(B) locating landing site and assessing wind speed and direction;

(C) reconnaissance of landing site;

(D) select markers;

(E) select direction and type of approach;

(F) circuit;

(G) approach to committed point and go-around;

(H) approach;

(I) clearing turn;

(J) landing;

(K) power check and performance assessment in and OGE;

(L) normal take-off to best angle of climb speed;

(M) vertical take-off from hover.

AMC2 FCL.110.H LAPL(H) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.H(b) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(H), in accordance with AMC1 FCL.110.H.

FCL.135.H LAPL(H) — Extension of privileges to another type or variant of helicopter

(a) The privileges of an LAPL(H) shall be limited to the specific type and variant of helicopter in which the skill test was taken. This limitation may be removed when the pilot has completed:

(1) 5 hours of flight instruction, including:

(i) 15 dual take-offs, approaches and landings;

(ii) 15 supervised solo take-offs, approaches and landings;

(2) a skill test to demonstrate an adequate level of practical skill in the new type. During this skill test, the applicant shall also demonstrate to the examiner an adequate level of theoretical knowledge for the other type in the following subjects:

— Operational procedures,

— Flight performance and planning,

— Aircraft general knowledge.

(b) Before the holder of an LAPL(H) can exercise the privileges of the licence in another variant of helicopter than the one used for the skill test, the pilot shall undertake differences or familiarisation training, as determined in the operational suitability data established in accordance with Part-21. The differences training shall be entered in the pilot's logbook or equivalent record and signed by the instructor.

GM1 FCL.135.A; FCL.135.H

FCL.140.H LAPL(H) — Recency requirements

(a) Holders of an LAPL(H) shall only exercise the privileges of their licence on a specific type when they have completed on helicopters of that type in the last 12 months:

(1) at least 6 hours of flight time as PIC, including 6 take-offs, approaches and landings; and

(2) refresher training of at least 1 hour total flight time with an instructor.

(b) Holders of an LAPL(H) who do not comply with the requirements in (a) shall:

(1) pass a proficiency check with an examiner on the specific type before they resume the exercise of the privileges of their licence; or

(2) perform the additional flight time or take-offs and landings, flying dual or solo under the supervision of an instructor, in order to fulfil the requirements in (a).

SECTION 4 - Specific requirements for the LAPL for sailplanes — LAPL(S)

FCL.105.S LAPL(S) — Privileges and conditions

(a) The privileges of the holder of an LAPL for sailplanes are to act as PIC on sailplanes and powered sailplanes. In order to exercise the privileges on a TMG, the holder shall comply with the requirements in FCL.135.S.

(b) Holders of an LAPL(S) shall only carry passengers once they have completed 10 hours of flight time or 30 launches as PIC on sailplanes or powered sailplanes after the issuance of the licence.

FCL.110.S LAPL(S) — Experience requirements and crediting

(a) Applicants for an LAPL(S) shall have completed at least 15 hours of flight instruction in sailplanes, or powered sailplanes, including at least:

(1) 10 hours of dual flight instruction;

(2) 2 hours of supervised solo flight time;

(3) 45 launches and landings;

(4) 1 solo cross-country flight of at least 50 km (27 NM) or 1 dual cross- country flight of at least 100 km (55 NM).

(b) Of the 15 hours required in (a), a maximum of 7 hours may be completed in a TMG.

(c) Crediting. Applicants with prior experience as PIC may be credited towards the requirements in (a).

The amount of credit shall be decided by the ATO where the pilot undergoes the training course, on the basis of a pre-entry flight test, but shall in any case:

(1) not exceed the total flight time as PIC;

(2) not exceed 50 % of the hours required in (a);

(3) not include the requirements in (a)(2) to (a)(4).

AMC1 FCL.110.S LAPL(S) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.S(c) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(S), in accordance with AMC1 FCL.110.S and FCL.210.S.

AMC1 FCL.110.S; FCL.210.S

FLIGHT INSTRUCTION FOR THE LAPL(S) AND THE SPL

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL (S) and SPL flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including verifying mass and balance, aircraft inspection and servicing, airspace and weather briefing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at high angle of attack (critically low air speeds), recognition of, and recovery from, incipient and full stalls and spins;

(v) flight at critically high air speeds, recognition of, and recovery from spiral dive;

(vi) normal and crosswind take-offs in respect with the different launch methods;

(vii) normal and crosswind landings;

(viii) short field landings and outlandings: field selection, circuit and landing hazards and precautions;

(ix) cross-country flying using visual reference, dead reckoning and available navigation aids;

(x) soaring techniques as appropriate to site conditions;

(xi) emergency actions;

(xii) compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the sailplane type.

(2) At the discretion of the instructors some of the exercises may be combined and some other exercises may be done in several flights.

(3) At least the exercises 1 to 12 have to be completed before the first solo flight.

(4) Each of the exercises involves the need for the applicant to be aware of the needs for good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the sailplane:

(A) characteristics of the sailplane;

(B) cockpit layout: instruments and equipment;

(C) light controls: stick, pedals, airbrakes, flaps and trim;

(D) cable release and undercarriage;

(E) checklists, drills and controls.

(ii) Exercise 2: Procedures if emergencies:

(A) use of safety equipment (parachute);

(B) action if system failures;

(C) bail-out procedures.

(iii) Exercise 3: Preparation for flight:

(A) pre-flight briefings;

(B) required documents on board;

(C) equipment required for the intended flight;

(D) ground handling, movements, tow out, parking and security;

(E) pre-flight external and internal checks;

(F) verifying in-limits mass and balance;

(G) harness, seat or rudder panel adjustments;

(H) passenger handling;

(I) pre-launch checks.

(iv) Exercise 4: Initial air experience:

(A) area familiarisation;

(B) look-out procedures.

(v) Exercise 5: Effects of controls:

(A) look-out procedures;

(B) use of visual references;

(C) primary effects when laterally level and when banked;

(D) reference attitude and effect of elevator;

(E) relationship between attitude and speed;

(F) effects of:

(a) flaps (if available);

(b) airbrakes.

(vi) Exercise 6: Coordinated rolling to and from moderate angles of bank:

(A) look-out procedures;

(B) further effects of aileron (adverse yaw) and rudder (roll);

(C) coordination;

(D) rolling to and from moderate angles of bank and return to straight flight.

(vii) Exercise 7: Straight flying:

(A) look-out procedures;

(B) maintaining straight flight;

(C) flight at critically high air speeds;

(D) demonstration of inherent pitch stability;

(E) control in pitch, including use of trim;

(F) lateral level, direction and balance and trim;

(G) air speed: instrument monitoring and control.

(viii) Exercise 8: Turning:

(A) look-out procedures;

(B) demonstration and correction of adverse yaw;

(C) entry to turn (medium level turns);

(D) stabilising turns;

(E) exiting turns;

(F) faults in the turn (slipping and skidding);

(G) turns on to selected headings and use of compass;

(H) use of instruments (ball indicator or slip string) for precision.

(ix) Exercise 9a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds (high angle of attack) and to provide practice in maintaining the sailplane in balance while returning to normal attitude (speed).

(A) safety checks;

(B) introduction to characteristics of slow flight;

(C) controlled flight down to critically high angle of attack (slow air speed).

(x) Exercise 9b: Stalling:

(A) safety checks;

(B) pre-stall symptoms, recognition and recovery;

(C) stall symptoms, recognition and recovery;

(D) recovery when a wing drops;

(E) approach to stall in the approach and in the landing configurations;

(F) recognition and recovery from accelerated stalls.

(xi) Exercise 10: Spin recognition and spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45°);

(C) entry into fully developed spins (if suitable training aircraft available);

(D) recognition of full spins (if suitable training aircraft available);

(E) standard spin recovery (if suitable training aircraft available);

(F) instructor induced distractions during the spin entry (if suitable training aircraft available).

Note: consideration of manoeuvre limitations and the need to refer to the sailplane manual and mass and balance calculations. If no suitable training aircraft is available to demonstrate the fully developed spin, all the aspects related to these training items have to be covered by specific theoretical instruction.

(xii) Exercise 11: Take-off or launch methods:

At least one launch method must be taught containing all the subjects below.

(xiii) Exercise 11a: Winch launch:

(A) signals or communication before and during launch;

(B) use of the launching equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) optimum profile of winch launch and limitations;

(G) release procedures;

(H) launch failure procedures.

(xiv) Exercise 11b: Aero tow:

(A) signals or communication before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) on tow: straight flight, turning and slip stream;

(G) out of position in tow and recovery;

(H) descending on tow (towing aircraft and sailplane);

(I) release procedures;

(J) launch failure and abandonment.

(xv) Exercise 11c: Self-launch:

(A) engine extending and retraction procedures;

(B) engine starting and safety precautions;

(C) pre-take-off checks;

(D) noise abatement procedures;

(E) checks during and after take-off;

(F) into wind take-off;

(G) crosswind take-off;

(H) power failures and procedures;

(I) abandoned take-off;

(J) maximum performance (short field and obstacle clearance) take-off;

(K) short take-off and soft field procedure or techniques and performance calculations.

(xvi) Exercise 11d: Car launch:

(A) signals before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) optimum launch profile and limitations;

(G) release procedures;

(H) launch failure procedures.

(xvii) Exercise 11e: Bungee launch:

(A) signals before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off.

(xviii) Exercise 12: Circuit, approach and landing:

(A) procedures for rejoining the circuit;

(B) collision avoidance, look-out techniques and procedures;

(C) pre-landing checks: circuit procedures, downwind and base leg;

(D) effect of wind on approach and touchdown speeds;

(E) use of flaps (if applicable);

(F) visualisation of an aiming point;

(G) approach control and use of airbrakes;

(H) normal and crosswind approach and landing;

(I) short landing procedures or techniques.

(xix) Exercise 13: First solo:

(A) instructor's briefing including limitations;

(B) awareness of local area and restrictions;

(C) use of required equipment;

(D) observation of flight and debriefing by instructor.

(xx) Exercise 14: Advanced turning:

(A) steep turns (45°);

(B) stalling and spin avoidance in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xxi) Exercise 15: Soaring techniques:

At least one of the three soaring techniques must be taught containing all subjects below.

(xxii) Exercise 15a: Thermalling:

(A) look-out procedures;

(B) detection and recognition of thermals;

(C) use of audio soaring instruments;

(D) joining a thermal and giving way;

(E) flying in close proximity to other sailplanes;

(F) centring in thermals;

(G) leaving thermals.

(xxiii) Exercise 15b: Ridge flying:

(A) look-out procedures;

(B) practical application of ridge flying rules;

(C) optimisation of flight path;

(D) speed control.

(xxiv) Exercise 15C: Wave flying:

(A) look-out procedures;

(B) wave access techniques;

(C) speed limitations with increasing height;

(D) use of oxygen.

(xxv) Exercise 16: Out-landings:

(A) gliding range;

(B) restart procedures (only for self-launching and self-sustaining sailplanes);

(C) selection of landing area;

(D) circuit judgement and key positions;

(E) circuit and approach procedures;

(F) actions after landing.

(xxvi) Exercise 17: Cross-country flying:

If the required cross-country flight will be conducted as a solo cross-country flight, all the subjects below must be taught before.

(xxvii) Exercise 17a: Flight planning:

(A) weather forecast and actuals;

(B) NOTAMs and airspace considerations;

(C) map selection and preparation;

(D) route planning;

(E) radio frequencies (if applicable);

(F) pre-flight administrative procedure;

(G) flight plan where required;

(H) mass and performance;

(I) alternate aerodromes and landing areas;

(J) safety altitudes.

(xxviii) Exercise 17b: In-flight navigation:

(A) maintaining track and re-routing considerations;

(B) use of radio and phraseology (if applicable);

(C) in-flight planning;

(D) procedures for transiting regulated airspace or ATC liaison where required;

(E) uncertainty of position procedure;

(F) lost procedure;

(G) use of additional equipment where required;

(H) joining, arrival and circuit procedures at remote aerodrome.

(xix) Exercise 17c: Cross-country techniques:

(A) look-out procedures;

(B) maximising potential cross-country performance;

(C) risk reduction and threat reaction.

FCL.130.S LAPL(S) — Launch methods

(a) The privileges of the LAPL(S) shall be limited to the launch method included in the skill test. This limitation may be removed when the pilot has completed:

(1) in the case of winch launch and car launch, a minimum of 10 launches in dual flight instruction, and 5 solo launches under supervision;

(2) in the case of aero tow or self launch, a minimum of 5 launches in dual flight instruction, and 5 solo launches under supervision. In the case of self launch, dual flight instruction may be done in a TMG;

(3) in the case of bungee launch, a minimum of 3 launches performed in dual flight instruction or solo under supervision.

(b) The completion of the additional training launches shall be entered in the logbook and signed by the instructor.

(c) In order to maintain their privileges in each launch method, pilots shall complete a minimum of 5 launches during the last 24 months, except for bungee launch, in which case pilots shall have completed only 2 launches.

(d) When the pilot does not comply with the requirement in (c), he/she shall perform the additional number of launches flying dual or solo under the supervision of an instructor in order to renew the privileges.

FCL.135.S LAPL(S) — Extension of privileges to TMG

The privileges of an LAPL(S) shall be extended to a TMG when the pilot has completed in an ATO, at least:

(a) 6 hours of flight instruction on a TMG, including:

(1) 4 hours of dual flight instruction;

(2) 1 solo cross-country flight of at least 150 km (80 NM), during which 1 full stop landing at an aerodrome different from the aerodrome of departure shall be performed;

(b) a skill test to demonstrate an adequate level of practical skill in a TMG. During this skill test, the applicant shall also demonstrate to the examiner an adequate level of theoretical knowledge for the TMG in the following subjects:

— Principles of flight,

— Operational procedures,

— Flight performance and planning,

— Aircraft general knowledge,

— Navigation.

AMC1 FCL.135.S; FCL.205.S

EXTENSION OF PRIVILEGES TO TMG: LAPL(S) AND SPL

(a) The aim of the flight training is to qualify LAPL(S) or SPL holders to exercise the privileges of the licence on a TMG.

(b) The ATO should issue a certificate of satisfactory completion of the training.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) Principles of flight:

(i) operating limitations (addition TMG);

(ii) propellers;

(iii) flight mechanics.

(2) Operational procedures for TMG:

(i) special operational procedures and hazards;

(ii) emergency procedures.

(3) Flight performance and planning:

(i) mass and balance considerations;

(ii) loading;

(iii) CG calculation;

(iv) load and trim sheet;

(v) performance of TMGs;

(vi) flight planning for VFR flights;

(vii) fuel planning;

(viii) pre-flight preparation;

(ix) ICAO flight plan;

(x) flight monitoring and in-flight re-planning.

(4) Aircraft general knowledge:

(i) system designs, loads, stresses, maintenance;

(ii) airframe;

(iii) landing gear, wheels, tyres, brakes;

(iv) fuel system;

(v) electrics;

(vi) piston engines;

(vii) propellers;

(viii) instrument and indication systems.

(5) Navigation:

(i) dead reckoning navigation (addition powered flying elements);

(ii) in-flight navigation (addition powered flying elements);

(iii) basic radio propagation theory;

(iv) radio aids (basics);

(v) radar (basics);

(vi) GNSS.

(d) Flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed.

(2) The flying exercises should cover the revision or explanation of the following exercises:

(i) Exercise 1: Familiarisation with the TMG:

(A) characteristics of the TMG;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1e: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) serviceability documents;

(B) equipment required, maps, etc.;

(C) external checks;

(D) internal checks;

(E) harness and seat or rudder panel adjustments;

(F) starting and warm-up checks;

(G) power checks;

(H) running down system checks and switching off the engine;

(I) parking, security and picketing (for example tie down);

(J) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures (if applicable).

(v) Exercise 3e: Emergencies: brake and steering failure.

(vi) Exercise 4: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance and trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(vii) Exercise 5: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(viii) Exercise 6: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(ix) Exercise 7: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (incorrect pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) slipping turns (on suitable types);

(G) turns onto selected headings, use of gyro heading indicator or compass;

(H) use of instruments for precision.

(x) Exercise 8a: Slow flight:

Note: the objective is to improve the pilot's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the TMG in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xi) Exercise 8b: Stalling:

(A) airmanship;

(B) safety checks;

(C) symptoms;

(D) recognition;

(E) clean stall and recovery without power and with power;

(F) recovery when a wing drops;

(G) approach to stall in the approach and in the landing configurations, with and without power, recovery at the incipient stage.

(xii) Exercise 9: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel (if applicable);

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure or techniques including performance calculations;

(G) noise abatement procedures.

(xiii) Exercise 10: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel (if applicable);

(D) effect of wind on approach and touchdown speeds;

(E) use of airbrakes, flaps, slats or spoilers;

(F) crosswind approach and landing;

(G) glide approach and landing (engine stopped);

(H) short landing and soft field procedures or techniques;

(I) flapless approach and landing (if applicable);

(J) wheel landing (tail wheel aeroplanes);

(K) missed approach and go-around;

(L) noise abatement procedures.

(xiv) Exercise 9/10e: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety it will be necessary for pilots trained on nose wheel TMGs to undergo dual conversion training before flying tail wheel TMGs, and vice versa.

(xv) Exercise 11: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xvi) Exercise 12: Stopping and restarting the engine:

(A) engine cooling procedures;

(B) switching off procedure in-flight;

(C) sailplane operating procedures;

(D) restarting procedure.

(xvii) Exercise 13: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine failure checks;

(G) use of radio;

(H) base leg;

(I) final approach;

(J) landing;

(K) actions after landing.

(xviii) Exercise 14: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xix) Exercise 15a: Navigation

(A) Flight planning

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) mass and performance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) TMG documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) Departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(C) En-route:

(a) maintenance of altitude and heading;

(b) revisions of ETA and heading;

(c) log keeping;

(d) use of radio or compliance with ATC procedures;

(e) minimum weather conditions for continuation of flight;

(f) in-flight decisions;

(g) transiting controlled or regulated airspace;

(h) diversion procedures;

(i) uncertainty of position procedure;

(j) lost procedure.

(D) Arrival, aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of TMG;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xx) Exercise 15b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxi) Exercise 15c: Radio navigation (basics):

(A) Use of GNSS or VOR/NDB;

(a) selection of waypoints;

(b) to or from indications or orientation;

(c) error messages.

(B) Use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) Use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar;

(1) transponders;

(2) code selection;

(3) interrogation and reply.

FCL.140.S LAPL(S) — Recency requirements

(a) Sailplanes and powered sailplanes. Holders of an LAPL(S) shall only exercise the privileges of their licence on sailplanes or powered sailplanes when they have completed on sailplanes or powered sailplanes, excluding TMGs, in the last 24 months, at least:

(1) 5 hours of flight time as PIC, including 15 launches;

(2) 2 training flights with an instructor.

(b) TMG. Holders of an LAPL(S) shall only exercise the privileges of their licence on a TMG when they have:

(1) completed on TMGs in the last 24 months:

(i) at least 12 hours of flight time as PIC, including 12 take-offs and landings; and

(ii) refresher training of at least 1 hour total flight time with an instructor.

(2) When the holder of the LAPL(S) also has the privileges to fly aeroplanes, the requirements in (1) may be completed on aeroplanes.

(c) Holders of an LAPL(S) who do not comply with the requirements in (a) or (b) shall, before they resume the exercise of their privileges:

(1) pass a proficiency check with an examiner on a sailplane or a TMG, as appropriate; or

(2) perform the additional flight time or take-offs and landings, flying dual or solo under the supervision of an instructor, in order to fulfil the requirements in (a) or (b).

SECTION 5 - Specific requirements for the LAPL for balloons — LAPL(B)

FCL.105.B LAPL(B) — Privileges

The privileges of the holder of an LAPL for balloons are to act as PIC on hot-air balloons or hot-air airships with a maximum of 3 400 m 3 envelope capacity or gas balloons with a maximum of 1 260 m 3 envelope capacity, carrying a maximum of 3 passengers, such that there are never more than 4 persons on board of the balloon.

FCL.110.B LAPL(B) — Experience requirements and crediting

(a) Applicants for an LAPL(B) shall have completed on balloons of the same class at least 16 hours of flight instruction, including at least:

(1) 12 hours of dual flight instruction;

(2) 10 inflations and 20 take-offs and landings; and

(3) 1 supervised solo flight with a minimum flight time of at least 30 minutes.

(b) Crediting. Applicants with prior experience as PIC on balloons may be credited towards the requirements in (a).

The amount of credit shall be decided by the ATO where the pilot undergoes the training course, on the basis of a pre-entry flight test, but shall in any case:

(1) not exceed the total flight time as PIC on balloons;

(2) not exceed 50 % of the hours required in (a);

(3) not include the requirements of (a)(2) and (a)(3).

AMC1 FCL.110.B LAPL(B) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.B(b) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(B), in accordance with AMC1 FCL.110.B and FCL.210.B.

AMC1 FCL.110.B; FCL.210.B

FLIGHT INSTRUCTION FOR THE LAPL(B) AND FLIGHT INSTRUCTION FOR THE BPL

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL(B) or BPL flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including load calculations, balloon inspection and servicing;

(ii) crew and passenger briefings;

(iii) inflation and crowd control;

(iv) control of the balloon by external visual reference;

(v) take-off in different wind conditions;

(vi) approach from low and high level;

(vii) landings in different surface wind conditions;

(viii) cross-country flying using visual reference and dead reckoning;

(ix) emergency operations, including simulated balloon equipment malfunctions;

(x) compliance with air traffic services procedures and communication procedures;

(xi) avoidance of nature protection areas, landowner relations.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction (hot-air balloon)

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the balloon type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the balloon:

(A) characteristics of the balloon;

(B) the components or systems;

(C) re-fuelling of the cylinders;

(D) instruments and equipment;

(E) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment;

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs

(b) airspace structure;

(c) sensitive areas (for example nature protection areas);

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) field selection;

(c) behaviour;

(d) adjacent fields.

(E) load calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefing;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope, basket and burner;

(C) burner test;

(D) use of restraint line;

(E) pre-inflation checks.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) cold inflation;

(C) use of the inflation fan;

(D) hot inflation.

(vi) Exercise 6: Take-off in different wind conditions:

(A) pre take-off checks and briefings;

(B) heating for controlled climb;

(C) ‘hands off and hands on' procedure for ground crew;

(D) assessment of lift;

(E) use of quick release;

(F) assessment of wind and obstacles;

(G) take-off in wind without shelter obstacles;

(H) preparation for false lift.

(vii) Exercise 7: Climb to level flight:

(A) climbing with a predetermined rate of climb;

(B) look-out procedures;

(C) effect on envelope temperature;

(D) maximum rate of climb according to manufacturer’s flight manual;

(E) levelling off at selected altitude.

(viii) Exercise 8: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) use of parachute and turning vents (if applicable).

(ix) Exercise 9: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) fast descent;

(C) look-out procedures;

(D) maximum rate of descent according to manufacturer's flight manual;

(E) use of parachute;

(F) parachute stall;

(G) cold descent;

(H) levelling off at selected altitude.

(x) Exercise 10: Emergencies – systems:

(A) pilot light failure;

(B) burner failure, valve leaks, flame out and re-light;

(C) gas leaks;

(D) envelope over temperature;

(E) envelope damage in-flight;

(F) parachute or rapid deflation system failure.

(xi) Exercise 10B: Other emergencies:

(A) fire extinguisher;

(B) fire on ground;

(C) fire in the air;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xii) Exercise 11: Navigation:

(A) maps selection;

(B) plotting expected track;

(C) marking positions and time;

(D) calculation of distance, speed and fuel consumption;

(E) ceiling limitations (ATC, weather and envelope temperature);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of fuel consumption and envelope temperature;

(I) ATC liaison (if applicable);

(J) communication with retrieve crew;

(K) use of GNSS (if applicable).

(xiii) Exercise 12: Fuel management:

(A) cylinder arrangement and burner systems;

(B) pilot light supply (vapour or liquid);

(C) use of master cylinders (if applicable);

(D) fuel requirement and expected fuel consumption;

(E) fuel state and pressure;

(F) fuel reserves;

(G) cylinder contents gauge and change procedure;

(H) use of cylinder manifolds.

(xiv) Exercise 13: Approach from low level:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) use of burner and parachute;

(E) look-out procedures;

(F) missed approach and fly on.

(xv) Exercise 14: Approach from high level:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) rate of descent;

(E) use of burner and parachute;

(F) look-out procedures;

(G) missed approach and fly on.

(xvi) Exercise 15: Operating at low level:

(A) use of burner, whisper burner and parachute;

(B) look-out procedures;

(C) avoidance of low level obstacles;

(D) avoidance of protection areas;

(E) landowner relations.

(xvii) Exercise 16: Landing in different wind conditions:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) turbulences (in the case of landings with high wind speed only);

(E) use of burner and pilot lights;

(F) use of parachute and turning vents (if applicable);

(G) look-out procedures;

(H) dragging and deflation;

(I) landowner relations;

(J) airmanship.

(xviii) Exercise 17: First solo:

(A) supervised flight preparation;

(B) instructor's briefing, observation of flight and de-briefing.

(d) Syllabus of flight instruction (gas balloon)

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the balloon type.

(2) Each of the exercises involves the need for the pilot-under-training to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the balloon:

(A) characteristics of the balloon;

(B) the components or systems;

(C) instruments and equipment;

(D) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs;

(b) airspace structure;

(c) sensitive areas (for example nature protection areas);

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) behaviour;

(c) adjacent fields.

(E) load calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefings;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope and basket (balloon with net);

(C) rigging envelope and basket (netless balloon);

(D) ballast check.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) inflation procedure according to manufacturer's flight manual;

(C) avoiding electrostatic discharge.

(vi) Exercise 6: Take-off in different wind conditions:

(A) pre take-off checks and briefings;

(B) prepare for controlled climb;

(C) 'hands off and hands on' procedure for ground crew;

(D) assessment of wind and obstacles;

(E) preparation for false lift.

(vii) Exercise 7: Climb to level flight:

(A) climb with a predetermined rate of climb;

(B) look-out procedures;

(C) maximum rate of climb according to manufacturer's flight manual;

(D) levelling off at selected altitude.

(viii) Exercise 8: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) use of parachute or valve.

(ix) Exercise 9: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) fast descent;

(C) look-out procedures;

(D) maximum rate of descent according to manufacturer's flight manual;

(E) use of parachute or valve;

(F) levelling off at selected altitude.

(x) Exercise 10: Emergencies:

(A) closed appendix during take-off and climb;

(B) envelope damage in-flight;

(C) parachute or valve failure;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xi) Exercise 11: Navigation:

(A) map selection;

(B) plotting expected track;

(C) marking positions and time;

(D) calculation of distance, speed and ballast consumption;

(E) ceiling limitations (ATC, weather and ballast);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of ballast consumption;

(I) ATC liaison (if applicable);

(J) communication with retrieve crew;

(K) use of GNSS (if applicable).

(xii) Exercise 12: Ballast management:

(A) minimum ballast;

(B) arrangement and securing of ballast;

(C) ballast requirement and expected ballast consumption;

(D) ballast reserves.

(xiii) Exercise 13: Approach from low level:

(A) pre-landing checks;

(B) passenger pre-landing checks;

(C) selection of field;

(D) use of ballast and parachute or valve;

(E) use of trail rope (if applicable);

(F) look-out procedures;

(G) missed approach and fly on.

(xiv) Exercise 14: Approach from high level:

(A) pre-landing checks;

(B) passenger pre-landing checks;

(C) selection of field;

(D) rate of descent;

(E) use of ballast and parachute or valve;

(F) use of trail rope (if applicable);

(G) look-out procedures;

(H) missed approach and fly on.

(xv) Exercise 15: Operating at low level:

(A) use of ballast and parachute or valve;

(B) look-out procedures;

(C) avoidance of low level obstacle;

(D) avoidance of protection areas;

(E) landowner relations.

(xvi) Exercise 16: Landing in different wind conditions:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) turbulences (in the case of landings with high wind speed only);

(E) use of ballast and parachute or valve;

(F) look-out procedures;

(G) use of rip panel;

(H) dragging;

(I) deflation;

(J) avoiding electrostatic discharge;

(K) landowner relations.

(xvii) Exercise 17: First solo:

Note: the exercises 1 to 16 have to be completed and the student must have achieved a safe and competent level before the first solo flight takes place.

(A) supervised flight preparation;

(B) instructor's briefing, observation of flight and de-briefing.

FCL.130.B LAPL(B) — Extension of privileges to tethered flights

(a) The privileges of the LAPL(B) shall be limited to non-tethered flights. This limitation may be removed when the pilot has completed at least 3 tethered instruction flights.

(b) The completion of the additional training shall be entered in the logbook and signed by the instructor.

(c) In order to maintain this privilege, pilots shall complete a minimum of 2 tethered flights during the last 24 months.

(d) When the pilot does not comply with the requirement in (c), he/she shall perform the additional number of tethered flights flying dual or solo under the supervision of an instructor in order to renew the privileges.

AMC1 FCL.130.B; FCL.220.B

FLIGHT INSTRUCTION FOR THE EXTENSION OF PRIVILEGES TO TETHERED FLIGHTS

(a) The aim of the flight instruction is to qualify LAPL(B) or BPL holders to perform tethered flights.

(b) The flying exercise should cover the following training items:

(1) ground preparations;

(2) weather suitability;

(3) tether points:

(i) upwind;

(ii) downwind.

(4) tether ropes (three point system);

(5) maximum all-up-weight limitation;

(6) crowd control;

(7) pre take-off checks and briefings;

(8) heating for controlled lift off;

(9) ‘hands off and hands on’ procedure for ground crew;

(10) assessment of lift;

(11) assessment of wind and obstacles;

(12) take-off and controlled climb (at least up to 60 ft – 20m).

FCL.135.B LAPL(B) — Extension of privileges to another balloon class

The privileges of the LAPL(B) shall be limited to the class of balloons in which the skill test was taken. This limitation may be removed when the pilot has completed in the other class, at an ATO, at least:

(a) 5 dual instruction flights; or

(b) in the case of an LAPL(B) for hot-air balloons wishing to extend their privileges to hot-air airships, 5 hours of dual flight instruction time; and

(c) a skill test, during which they shall demonstrate to the examiner an adequate level of theoretical knowledge for the other class in the following subjects:

— Principles of flight,

— Operational procedures,

— Flight performance and planning, and

— Aircraft general knowledge.

AMC1 FCL.135.B; FCL.225.B

THEORETICAL KNOWLEDGE INSTRUCTION FOR THE EXTENSION TO ANOTHER BALLOON CLASS: LAPL(B) AND BPL

(a) The aim of the flight instruction is to qualify LAPL(B) or BPL holders to exercise the privileges on a different class of balloons.

(b) The following classes are recognised:

(1) hot-air balloons;

(2) gas balloons;

(3) hot-air airships.

(c) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

(d) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) principles of flight:

(i) operating limitations;

(ii) loading limitations.

(2) operational procedures:

(i) special operational procedures and hazards;

(ii) emergency procedures.

(3) flight performance and planning:

(i) mass considerations;

(ii) loading;

(iii) performance (hot-air balloon, gas balloon or hot-air airship);

(iv) flight planning;

(v) fuel planning;

(vi) flight monitoring.

(4) aircraft general knowledge:

(i) system designs, loads, stresses and maintenance;

(ii) envelope;

(iii) burner (only extension to hot-air balloon or airship);

(iv) fuel cylinders (except gas balloon);

(v) basket or gondola;

(vi) lifting or burning gas;

(vii) ballast (only gas balloon);

(viii) engine (only hot-air airship);

(ix) instruments and indication systems;

(x) emergency equipment.

AMC2 FCL.135.B; FCL.225.B

FLIGHT INSTRUCTION FOR THE EXTENSION TO ANOTHER BALLOON CLASS: LAPL(B) AND BPL

(a) This additional syllabus of flight instruction should be used for the extension of privileges for LAPL(B) and BPL - hot-air balloon to hot-air airship.

(b) The prerequisite for the extension of privileges to hot-air airships is a valid BPL or LAPL for hot-air balloons because a hot-air airship with a failed engine must be handled in a similar manner as a hot-air balloon. The conversion training has to concentrate therefore on the added complication of the engine, its controls and the different operating limitations of a hot-air airship.

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed.

(2) The flying exercises should cover the revision or explanation of the following exercises:

(i) Exercise 1: Familiarisation with the hot-air airship:

(A) characteristics of the hot-air airship;

(B) the components or systems;

(C) instruments and equipment;

(D) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment;

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs;

(b) airspace structure;

(c) sensitive areas;

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) behaviour;

(c) field selection;

(d) adjacent fields.

(E) load and fuel calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefing;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope, gondola, burner and engine;

(C) burner test;

(D) pre-inflation checks.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) cold inflation:

(a) use of restraint line;

(b) use of the inflation fan.

(C) hot inflation.

(vi) Exercise 6: Engine:

(A) identification of main parts and controls;

(B) familiarisation with operation and checking of the engine;

(C) engine checks before take-off.

(vii) Exercise 7: Pressurisation:

(A) pressurisation fan operation;

(B) super pressure and balance between pressure and temperature;

(C) pressure limitations.

(viii) Exercise 8: Take-off:

(A) before take-off checks and briefings;

(B) heating for controlled climb;

(C) procedure for ground crew;

(D) assessment of wind and obstacles.

(ix) Exercise 9: Climb to level flight:

(A) climbing with a predetermined rate of climb;

(B) effect on envelope temperature and pressure;

(C) maximum rate of climb according to manufacturer's flight manual;

(D) level off at selected altitude.

(x) Exercise 10: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) maintaining level flight at different air speeds by taking aerodynamic lift into account.

(xi) Exercise 11: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) maximum rate of descent according to manufacturer's flight manual;

(C) levelling off at selected altitude.

(xii) Exercise 12: Emergencies - systems:

(A) engine failure;

(B) pressurisation failure;

(C) rudder failure;

(D) pilot light failure;

(E) burner failure, valve leaks, flame out and re-light;

(F) gas leaks;

(G) envelope over temperature;

(H) envelope damage in-flight.

(xiii) Exercise 12B: Other emergencies:

(A) fire extinguishers;

(B) fire on ground;

(C) fire in the air;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xiv) Exercise 13: Navigation:

(A) map selection and preparation;

(B) plotting and steering expected track;

(C) marking positions and time;

(D) calculation of distance, speed and fuel consumption;

(E) ceiling limitations (ATC, weather and envelope temperature);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of fuel and envelope temperature or pressure;

(I) ATC liaison (if applicable);

(J) communication with ground crew;

(K) use of GNSS (if applicable).

(xv) Exercise 14: Fuel management:

(A) engine arrangement and tank system;

(B) cylinder arrangement and burner systems;

(C) pilot light supply (vapour or liquid);

(D) fuel requirement and expected fuel consumption for engine and burner;

(E) fuel state and pressure;

(F) fuel reserves;

(G) cylinder and petrol tank contents gauge.

(xvi) Exercise 15: Approach and go-around:

(A) pre-landing checks;

(B) selection of field into wind;

(C) use of burner and engine;

(D) look-out procedures;

(E) missed approach and go-around.

(xvii) Exercise 16: Approach with simulated engine failure:

(A) pre-landing checks;

(B) selection of field;

(C) use of burner;

(D) look-out procedures;

(E) missed approach and go-around.

(xviii) Exercise 17: Operating at low level:

(A) use of burner and engine;

(B) look-out procedures;

(C) avoidance of low level obstacles;

(D) avoidance of sensitive areas (nature protection areas) or landowner relations.

(xix) Exercise 18: Steering:

(A) assessment of wind;

(B) correcting for wind to steer a given course.

(xx) Exercise 19: Final landing:

(A) pre-landing checks;

(B) use of burner and engine;

(C) look-out;

(D) deflation;

(E) landowner relations.

FCL.140.B LAPL(B) — Recency requirements

(a) Holders of an LAPL(B) shall only exercise the privileges of their licence when they have completed, in one class of balloons in the last 24 months, at least:

(1) 6 hours of flight time as PIC, including 10 take-offs and landings; and

(2) 1 training flight with an instructor;

(3) in addition, if the pilot is qualified to fly more than one class of balloons, in order to exercise their privileges in the other class, they shall have completed at least 3 hours of flight time in that class within the last 24 months, including 3 take-offs and landings.

(b) Holders of an LAPL(B) who do not comply with the requirements in (a) shall, before they resume the exercise of their privileges:

(1) pass a proficiency check with an examiner in the appropriate class; or

(2) perform the additional flight time or take-offs and landings, flying dual or solo under the supervision of an instructor, in order to fulfil the requirements in (a).

SUBPART C - PRIVATE PILOT LICENCE (PPL), SAILPLANE PILOT LICENCE (SPL) AND BALLOON PILOT LICENCE (BPL)

SECTION 1 - Common requirements

FCL.200 Minimum age

(a) An applicant for a PPL shall be at least 17 years of age;

(b) An applicant for a BPL or an SPL shall be at least 16 years of age.

FCL.205 Conditions

Applicants for the issue of a PPL shall have fulfilled the requirements for the class or type rating for the aircraft used in the skill test, as established in Subpart H.

FCL.210 Training course

Applicants for a BPL, SPL or PPL shall complete a training course at an ATO. The course shall include theoretical knowledge and flight instruction appropriate to the privileges given.

AMC1 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE PPL(A) AND PPL(H)

The following tables contain the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the PPL(A) and PPL(H). The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated to the licence and the activity. An approved course shall comprise at least 100 hours of theoretical knowledge instruction. This theoretical knowledge instruction provided by the ATO should include a certain element of formal classroom work but may include also such facilities as interactive video, slide or tape presentation, computer-based training and other media distance learning courses. The training organisation responsible for the training has to check if all the appropriate elements of the training course of theoretical knowledge instruction have been completed to a satisfactory standard before recommending the applicant for the examination.

The applicable items for each licence are marked with 'x'. An 'x' on the main title of a subject means that all the sub-divisions are applicable.

		Aeroplane		Helicopter	
		PPL	Bridgecourse	PPL	Bridge course
1.	**AIR LAW AND ATC PROCEDURES**				
	International law: conventions, agreements and organisations				
	The Convention on international civil aviation (Chicago) Doc. 7300/6				

		Aeroplane		Helicopter	
		PPL	Bridgecourse	PPL	Bridge course
	Part I Air Navigation: relevant parts of the following chapters:	x		x	
	(a) general principles and application of the convention;				
	(b) flight over territory of Contracting States; (c) nationality of aircraft;				
	(d) measures to facilitate air navigation; (e) conditions to be fulfilled on aircraft;				
	(f) international standards and recommended practices; (g) validity of endorsed certificates and licences; (h) notification of differences.				
	Part II The International Civil Aviation Organisation (ICAO): objectives and composition	x		x	
	Annex 8: Airworthiness of aircraft				
	Foreword and definitions	x		x	
	Certificate of airworthiness	x		x	
	Annex 7: Aircraft nationality and registration marks				
	Foreword and definitions	x		x	
	Common- and registration marks	x		x	
	Certificate of registration and aircraft nationality	x		x	
	Annex 1: Personnel licensing				
	Definitions	x		x	
	Relevant parts of Annex 1 connected to Part-FCL and Part-Medical	x		x	
	Annex 2: Rules of the air				
	Essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight rules, signals and interception of civil aircraft	x		x	
	Procedures for air navigation: aircraft operations doc. 8168-ops/611, volume 1				
	Altimeter setting procedures (including IACO doc. 7030 – regional supplementary procedures)				

		Aeroplane		Helicopter	
		PPL	Bridgecourse	PPL	Bridge course
	Basic requirements (except tables), procedures applicable to operators and pilots (except tables)	x		x	
	Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – regional supplementary procedures)				
	Operation of transponders	x		x	
	Phraseology	x		x	
	Annex 11: Doc. 4444 air traffic management				
	Definitions	x		x	
	General provisions for air traffic services	x		x	
	Visual separation in the vicinity of aerodromes	x		x	
	Procedures for aerodrome control services	x		x	
	Radar services	x		x	
	Flight information service and alerting service	x		x	
	Phraseologies	x		x	
	Procedures related to emergencies, communication failure and contingencies	x		x	
	Annex 15: Aeronautical information service				
	Introduction, essential definitions	x		x	
	AIP, NOTAM, AIRAC and AIC	x		x	
	Annex 14, volume 1 and 2: Aerodromes				
	Definitions	x		x	
	Aerodrome data: conditions of the movement area and related facilities	x		x	
	Visual aids for navigation:	x		x	
	(a) indicators and signalling devices;				
	(b) markings;				
	(c) lights;				
	(d) signs;				
	(e) markers.				
	Visual aids for denoting obstacles:	x		x	
	(a) marking of objects;				
	(b) lighting of objects.				
	Visual aids for denoting restricted use of areas	x		x	
	Emergency and other services:	x		x	

		Aeroplane		Helicopter	
		PPL	Bridgecourse	PPL	Bridge course
	(a) rescue and fire fighting;				
	(b) apron management service.				
	Annex 12: Search and rescue				
	Essential definitions	x		x	
	Operating procedures:	x		x	
	(a) procedures for PIC at the scene of an accident;				
	(b) procedures for PIC intercepting a distress transmission;				
	(c) search and rescue signals.				
	Search and rescue signals:	x		x	
	(a) signals with surface craft;				
	(b) ground or air visual signal code;				
	(c) air or ground signals.				
	Annex 17: Security				
	General: aims and objectives	x		x	
	Annex 13: Aircraft accident investigation				
	Essential definitions	x		x	
	Applicability	x		x	
	National law				
	National law and differences to relevant ICAO Annexes and relevant EU regulations.	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
2.	**HUMAN PERFORMANCE**				
	Human factors: basic concepts				
	Human factors in aviation				
	Becoming a competent pilot	x		x	
	Basic aviation physiology and health maintenance				
	The atmosphere:	x		x	
	(a) composition;				
	(b) gas laws.				
	Respiratory and circulatory systems:	x		x	
	(a) oxygen requirement of tissues;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) functional anatomy;				
	(c) main forms of hypoxia (hypoxic and anaemic):				
	(1) sources, effects and counter-measures of carbon monoxide;				
	(2) counter measures and hypoxia;				
	(3) symptoms of hypoxia.				
	(d) hyperventilation;				
	(e) the effects of accelerations on the circulatory system;				
	(f) hypertension and coronary heart disease.				
	Man and environment				
	Central, peripheral and autonomic nervous systems	x		x	
	Vision:	x		x	
	(a) functional anatomy;				
	(b) visual field, foveal and peripheral vision;				
	(c) binocular and monocular vision;				
	(d) monocular vision cues;				
	(e) night vision;				
	(f) visual scanning and detection techniques and importance of 'look-out';				
	(g) defective vision.				
	Hearing:	x		x	
	(a) descriptive and functional anatomy;				
	(b) flight related hazards to hearing;				
	(c) hearing loss.				
	Equilibrium:	x		x	
	(a) functional anatomy;				
	(b) motion and acceleration;				
	(c) motion sickness.				
	Integration of sensory inputs:	x		x	
	(a) spatial disorientation: forms, recognition and avoidance;				
	(b) illusions: forms, recognition and avoidance:				
	(1) physical origin;				
	(2) physiological origin;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(3) psychological origin.				
	(c) approach and landing problems.				
	Health and hygiene				
	Personal hygiene: personal fitness	x		x	
	Body rhythm and sleep:	x		x	
	(a) rhythm disturbances;				
	(b) symptoms, effects and management.				
	Problem areas for pilots:	x		x	
	(a) common minor ailments including cold, influenza and gastro-intestinal upset;				
	(b) entrapped gases and barotrauma, (scuba diving);				
	(c) obesity;				
	(d) food hygiene;				
	(e) infectious diseases;				
	(f) nutrition;				
	(g) various toxic gases and materials.				
	Intoxication:	x		x	
	(a) prescribed medication;				
	(b) tobacco;				
	(c) alcohol and drugs;				
	(d) caffeine;				
	(e) self-medication.				
	Basic aviation psychology				
	Human information processing				
	Attention and vigilance:	x		x	
	(a) selectivity of attention;				
	(b) divided attention.				
	Perception:	x		x	
	(A) perceptual illusions;				
	(B) subjectivity of perception;				
	(C) processes of perception.				
	Memory:	x		x	
	(a) sensory memory;				
	(b) working or short term memory;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(c) long term memory to include motor memory (skills).				
	Human error and reliability				
	Reliability of human behaviour	x		x	
	Error generation: social environment (group, organisation)	x		x	
	Decision making				
	Decision-making concepts:	x		x	
	(a) structure (phases);				
	(b) limits;				
	(c) risk assessment;				
	(d) practical application.				
	Avoiding and managing errors: cockpit management				
	Safety awareness:	x		x	
	(a) risk area awareness;				
	(b) situational awareness.				
	Communication: verbal and non-verbal communication	x		x	
	Human behaviour				
	Personality and attitudes:	x		x	
	(a) development;				
	(b) environmental influences.				
	Identification of hazardous attitudes (error proneness)	x		x	
	Human overload and underload				
	Arousal	x		x	
	Stress:	x		x	
	(a) definition(s);				
	(b) anxiety and stress;				
	(c) effects of stress.				
	Fatigue and stress management:	x		x	
	(a) types, causes and symptoms of fatigue;				
	(b) effects of fatigue;				
	(c) coping strategies;				
	(d) management techniques;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(e) health and fitness programmes;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
3.	**METEOROLOGY**				
	The atmosphere				
	Composition, extent and vertical division				
	Structure of the atmosphere	x		x	
	Troposphere	x		x	
	Air temperature				
	Definition and units	x		x	
	Vertical distribution of temperature	x		x	
	Transfer of heat	x		x	
	Lapse rates, stability and instability	x		x	
	Development of inversions and types of inversions	x		x	
	Temperature near the earth's surface, surface effects, diurnal and seasonal variation, effect of clouds and effect of wind	x		x	
	Atmospheric pressure				
	Barometric pressure and isobars	x		x	
	Pressure variation with height	x		x	
	Reduction of pressure to mean sea level	x		x	
	Relationship between surface pressure centres and pressure centres aloft	x		x	
	Air density				
	Relationship between pressure, temperature and density	x		x	
	ISA				
	ICAO standard atmosphere	x		x	
	Altimetry				
	Terminology and definitions	x		x	
	Altimeter and altimeter settings	x		x	
	Calculations	x		x	
	Effect of accelerated airflow due to topography	x		x	
	Wind				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Definition and measurement of wind				
	Definition and measurement	x		x	
	Primary cause of wind				
	Primary cause of wind, pressure gradient, coriolis force and gradient wind	x		x	
	Variation of wind in the friction layer	x		x	
	Effects of convergence and divergence	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
4.	**COMMUNICATIONS**				
	VFR COMMUNICATIONS				
	Definitions				
	Meanings and significance of associated terms	x		x	
	ATS abbreviations	x		x	
	Q-code groups commonly used in RTF air-ground communications	x		x	
	Categories of messages	x		x	
	General operating procedures				
	Transmission of letters	x		x	
	Transmission of numbers (including level information)	x		x	
	Transmission of time	x		x	
	Transmission technique	x		x	
	Standard words and phrases (relevant RTF phraseology included)	x		x	
	R/T call signs for aeronautical stations including use of abbreviated call signs	x		x	
	R/T call signs for aircraft including use of abbreviated call signs	x		x	
	Transfer of communication	x		x	
	Test procedures including readability scale	x		x	
	Read back and acknowledgement requirements	x		x	
	Relevant weather information terms (VFR)				
	Aerodrome weather	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Weather broadcast	x		x	
	Action required to be taken in case of communication failure	x		x	
	Distress and urgency procedures				
	Distress (definition, frequencies, watch of distress frequencies, distress signal and distress message)	x		x	
	Urgency (definition, frequencies, urgency signal and urgency message)	x		x	
	General principles of VHF propagation and allocation of frequencies	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
5.	PRINCIPLES OF FLIGHT				
5.1.	PRINCIPLES OF FLIGHT: AEROPLANE				
	Subsonic aerodynamics				
	Basics concepts, laws and definitions				
	Laws and definitions: (a) conversion of units; (b) Newton´s laws; (c) Bernoulli's equation and venture; (d) static pressure, dynamic pressure and total pressure; (e) density; (f) IAS and TAS.	x	x		
	Basics about airflow: (a) streamline; (b) two-dimensional airflow; (c) three-dimensional airflow.	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Aerodynamic forces on surfaces: (a) resulting airforce; (b) lift; (c) drag; (d) angle of attack.	x	x		
	Shape of an aerofoil section: (a) thickness to chord ratio; (b) chord line; (c) camber line; (d) camber; (e) angle of attack.	x	x		
	The wing shape: (a) aspect ratio; (b) root chord; (c) tip chord; (d) tapered wings; (e) wing planform.	x	x		
	The two-dimensional airflow about an aerofoil				
	Streamline pattern	x	x		
	Stagnation point	x	x		
	Pressure distribution	x	x		
	Centre of pressure	x	x		
	Influence of angle of attack	x	x		
	Flow separation at high angles of attack	x	x		
	The lift – α graph	x	x		
	The coefficients				
	The lift coefficient Cl: the lift formula	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	The drag coefficient Cd: the drag formula	x	x		
	The three-dimensional airflow round a wing and a fuselage				
	Streamline pattern: (a) span-wise flow and causes; (b) tip vortices and angle of attack; (c) upwash and downwash due to tip vortices; (d) wake turbulence behind an aeroplane (causes, distribution and duration of the phenomenon).	x	x		
	Induced drag: (a) influence of tip vortices on the angle of attack; (b) the induced local α; (c) influence of induced angle of attack on the direction of the lift vector; (d) induced drag and angle of attack.	x	x		
	Drag				
	The parasite drag: (a) pressure drag; (b) interference drag; (c) friction drag.	x	x		
	The parasite drag and speed	x	x		
	The induced drag and speed	x	x		
	The total drag	x	x		
	The ground effect				
	Effect on take off and landing characteristics of an aeroplane	x	x		
	The stall				
	Flow separation at increasing angles of attack: (a) the boundary layer:	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(1) laminar layer; (2) turbulent layer; (3) transition. (b) separation point; (c) influence of angle of attack; (d) influence on: (1) pressure distribution; (2) location of centre of pressure; (3) CL; (4) CD; (5) pitch moments. (e) buffet; (f) use of controls.				
	The stall speed: (a) in the lift formula; (b) 1g stall speed; (c) influence of: (1) the centre of gravity; (2) power setting; (3) altitude (IAS); (4) wing loading; (5) load factor n: (i) definition; (ii) turns; (iii) forces.	x	x		
	The initial stall in span-wise direction: (a) influence of planform; (b) geometric twist (wash out);	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(c) use of ailerons.				
	Stall warning: (a) importance of stall warning; (b) speed margin; (c) buffet; (d) stall strip; (e) flapper switch; (f) recovery from stall.	x	x		
	Special phenomena of stall: (a) the power-on stall; (b) climbing and descending turns; (c) t-tailed aeroplane; (d) avoidance of spins: (1) spin development; (2) spin recognition; (3) spin recovery. (e) ice (in stagnation point and on surface): (1) absence of stall warning; (2) abnormal behaviour of the aircraft during stall.	x	x		
	CL augmentation				
	Trailing edge flaps and the reasons for use in take-off and landing: (a) influence on CL - α-graph; (b) different types of flaps; (c) flap asymmetry; (d) influence on pitch movement.	x	x		
	Leading edge devices and the reasons for use in take-off and landing	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	The boundary layer				
	Different types: (a) laminar; (b) turbulent.	x	x		
	Special circumstances				
	Ice and other contamination: (a) ice in stagnation point; (b) ice on the surface (frost, snow and clear ice); (c) rain; (d) contamination of the leading edge; (e) effects on stall; (f) effects on loss of controllability; (g) effects on control surface moment; (h) influence on high lift devices during take-off, landing and low speeds.	x	x		
	Stability				
	Condition of equilibrium in steady horizontal flight				
	Precondition for static stability	x	x		
	Equilibrium: (a) lift and weight; (b) drag and thrust.	x	x		
	Methods of achieving balance				
	Wing and empennage (tail and canard)	x	x		
	Control surfaces	x	x		
	Ballast or weight trim	x	x		
	Static and dynamic longitudinal stability				
	Basics and definitions: (a) static stability, positive, neutral and negative;	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) precondition for dynamic stability; (c) dynamic stability, positive, neutral and negative.				
	Location of centre of gravity: (a) aft limit and minimum stability margin; (b) forward position; (c) effects on static and dynamic stability.	x	x		
	Dynamic lateral or directional stability				
	Spiral dive and corrective actions	x	x		
	Control				
	General				
	Basics, the three planes and three axis	x	x		
	Angle of attack change	x	x		
	Pitch control				
	Elevator	x	x		
	Downwash effects	x	x		
	Location of centre of gravity	x	x		
	Yaw control				
	Pedal or rudder	x	x		
	Roll control				
	Ailerons: function in different phases of flight	x	x		
	Adverse yaw	x	x		
	Means to avoid adverse yaw: (a) frise ailerons; (b) differential ailerons deflection.	x	x		
	Means to reduce control forces				
	Aerodynamic balance: (a) balance tab and anti-balance tab;	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) servo tab.				
	Mass balance				
	Reasons to balance: means	x	x		
	Trimming				
	Reasons to trim	x	x		
	Trim tabs	x	x		
	Limitations				
	Operating limitations				
	Flutter	x	x		
	vfe	x	x		
	vno, vne	x	x		
	Manoeuvring envelope				
	Manoeuvring load diagram: (a) load factor; (b) accelerated stall speed; (c) va; (d) manoeuvring limit load factor or certification category.	x	x		
	Contribution of mass	x	x		
	Gust envelope				
	Gust load diagram	x	x		
	Factors contributing to gust loads	x	x		
	Propellers				
	Conversion of engine torque to thrust				
	Meaning of pitch	x	x		
	Blade twist	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Effects of ice on propeller	x	x		
	Engine failure or engine stop				
	Windmilling drag	x	x		
	Moments due to propeller operation				
	Torque reaction	x	x		
	Asymmetric slipstream effect	x	x		
	Asymmetric blade effect	x	x		
	Flight mechanics				
	Forces acting on an aeroplane				
	Straight horizontal steady flight	x	x		
	Straight steady climb	x	x		
	Straight steady descent	x	x		
	Straight steady glide	x	x		
	Steady coordinated turn: (a) bank angle; (b) load factor; (c) turn radius; (d) rate one turn.	x	x		
5.2.	PRINCIPLES OF FLIGHT: HELICOPTER				
	Subsonic aerodynamics				
	Basic concepts, laws and definitions			x	x
	Conversion of units			x	x
	Definitions and basic concepts about air:			x	x
	(a) the atmosphere and International Standard Atmosphere;				
	(b) density;				
	(c) influence of pressure and temperature on density.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Newton's laws:			x	x
	(a) Newton's second law: Momentum equation;				
	(b) Newton's third law: action and reaction.				
	Basic concepts about airflow:			x	x
	(a) steady airflow and unsteady airflow;				
	(b) Bernoulli's equation;				
	(c) static pressure, dynamic pressure, total pressure and stagnation point;				
	(d) TAS and IAS;				
	(e) two-dimensional airflow and three-dimensional airflow;				
	(f) viscosity and boundary layer.				
	Two-dimensional airflow			x	x
	Aerofoil section geometry:			x	x
	(a) aerofoil section;				
	(b) chord line, thickness and thickness to chord ratio of a section;				
	(c) camber line and camber;				
	(d) symmetrical and asymmetrical aerofoils sections.				
	Aerodynamic forces on aerofoil elements:			x	x
	(a) angle of attack;				
	(b) pressure distribution;				
	(c) lift and lift coefficient				
	(d) relation lift coefficient: angle of attack;				
	(e) profile drag and drag coefficient;				
	(f) relation drag coefficient: angle of attack;				
	(g) resulting force, centre of pressure and pitching moment.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Stall:			x	x
	(a) boundary layer and reasons for stalling;				
	(b) variation of lift and drag as a function of angle of attack;				
	(c) displacement of the centre of pressure and pitching moment.				
	Disturbances due to profile contamination:			x	x
	(a) ice contamination;				
	(b) ice on the surface (frost, snow and clear ice).				
	The three-dimensional airflow round a wing and a fuselage			x	x
	The wing:			x	x
	(a) planform, rectangular and tapered wings;				
	(b) wing twist.				
	Airflow pattern and influence on lift:			x	x
	(a) span wise flow on upper and lower surface;				
	(b) tip vortices;				
	(c) span-wise lift distribution.				
	Induced drag: causes and vortices			x	x
	The airflow round a fuselage:			x	x
	(a) components of a fuselage;				
	(b) parasite drag;				
	(c) variation with speed.				
	Transonic aerodynamics and compressibility effects				
	Airflow velocities			x	x
	Airflow speeds:			x	x
	(a) speed of sound;				
	(b) subsonic, high subsonic and supersonic flows.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Shock waves:			x	x
	(a) compressibility and shock waves;				
	(b) the reasons for their formation at upstream high subsonic airflow;				
	(c) their effect on lift and drag.				
	Influence of wing planform: sweep-angle			x	x
	Rotorcraft types			x	x
	Rotorcraft			x	x
	Rotorcraft types:			x	x
	(a) autogyro;				
	(b) helicopter.				
	Helicopters			x	x
	Helicopters configurations: the single main rotor helicopter			x	x
	The helicopter, characteristics and associated terminology:			x	x
	(a) general lay-out, fuselage, engine and gearbox;				
	(b) tail rotor, fenestron and NOTAR;				
	(c) engines (reciprocating and turbo shaft engines);				
	(d) power transmission;				
	(e) rotor shaft axis, rotor hub and rotor blades;				
	(f) rotor disc and rotor disc area;				
	(g) teetering rotor (two blades) and rotors with more than two blades;				
	(h) skids and wheels;				
	(i) helicopter axes and fuselage centre line;				
	(j) roll axis, pitch axis and normal or yaw axis;				
	(k) gross mass, gross weight and disc loading.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Main rotor aerodynamics			x	x
	Hover flight outside ground effect			x	x
	Airflow through the rotor discs and round the blades:			x	x
	(a) circumferential velocity of the blade sections;				
	(b) induced airflow, through the disc and downstream;				
	(c) downward fuselage drag;				
	(d) equilibrium of rotor thrust, weight and fuselage drag;				
	(e) rotor disc induced power;				
	(f) relative airflow to the blade;				
	(g) pitch angle and angle of attack of a blade section;				
	(h) lift and profile drag on the blade element;				
	(i) resulting lift and thrust on the blade and rotor thrust;				
	(j) collective pitch angle changes and necessity of blade feathering;				
	(k) required total main rotor-torque and rotor-power;				
	(l) influence of the air density.				
	Anti-torque force and tail rotor:			x	x
	(a) force of tail rotor as a function of main rotor-torque;				
	(b) anti-torque rotor power;				
	(c) necessity of blade feathering of tail rotor blades and yaw pedals.				
	Maximum hover altitude OGE:			x	x
	(a) total power required and power available;				
	(b) maximum hover altitude as a function of pressure altitude and OAT.				
	Vertical climb			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Relative airflow and angles of attack:			x	x
	(a) climb velocity VC, induced and relative velocity and angle of attack;				
	(b) collective pitch angle and blade feathering.				
	Power and vertical speed:			x	x
	(a) induced power, climb power and profile power;				
	(b) total main rotor power and main rotor torque;				
	(c) tail rotor power;				
	(d) total power requirement in vertical flight.				
	Forward flight			x	x
	Airflow and forces in uniform inflow distribution:			x	x
	(a) assumption of uniform inflow distribution on rotor disc;				
	(b) advancing blade (90°) and retreating blade (270°);				
	(c) airflow velocity relative to the blade sections, area of reverse flow;				
	(d) lift on the advancing and retreating blades at constant pitch angles;				
	(e) necessity of cyclic pitch changes;				
	(f) compressibility effects on the advancing blade tip and speed limitations;				
	(g) high angle of attack on the retreating blade, blade stall and speed limitations;				
	(h) thrust on rotor disc and tilt of thrust vector;				
	(i) vertical component of the thrust vector and gross weight equilibrium;				
	(j) horizontal component of the thrust vector and drag equilibrium.				
	The flare (power flight):			x	x
	(a) thrust reversal and increase in rotor thrust;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) increase of rotor RPM on non governed rotor.				
	Power and maximum speed:			x	x
	(a) induced power as a function of helicopter speed;				
	(b) rotor profile power as a function of helicopter speed;				
	(c) fuselage drag and parasite power as a function of forward speed;				
	(d) tail rotor power and power ancillary equipment;				
	(e) total power requirement as a function of forward speed;				
	(f) influence of helicopter mass, air density and drag of additional external equipment;				
	(g) translational lift and influence on power required.				
	Hover and forward flight in ground effect			x	x
	Airflow in ground effect and downwash: rotor power decrease as a function of rotor height above the ground at constant helicopter mass			x	x
	Vertical descent			x	x
	Vertical descent, power on:			x	x
	(a) airflow through the rotor, low and moderate descent speeds;				
	(b) vortex ring state, settling with power and consequences.				
	Autorotation:			x	x
	(a) collective lever position after failure;				
	(b) up flow through the rotor, auto-rotation and anti-autorotation rings;				
	(c) tail rotor thrust and yaw control;				
	(d) control of rotor RPM with collective lever;				
	(e) landing after increase of rotor thrust by pulling collective and reduction in vertical speed.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Forward flight: Autorotation			x	x
	Airflow through the rotor disc:			x	x
	(a) descent speed and up flow through the disc;				
	(b) the flare, increase in rotor thrust, reduction of vertical speed and ground speed.				
	Flight and landing:			x	x
	(a) turning;				
	(b) flare;				
	(c) autorotative landing;				
	(d) height or velocity avoidance graph and dead man's curve.				
	Main rotor mechanics			x	x
	Flapping of the blade in hover			x	x
	Forces and stresses on the blade:			x	x
	(a) centrifugal force on the blade and attachments;				
	(b) limits of rotor RPM;				
	(c) lift on the blade and bending stresses on a rigid attachment;				
	(d) the flapping hinge of the articulated rotor and flapping hinge offset;				
	(e) the flapping of the hinge less rotor and flexible element.				
	Coning angle in hover:			x	x
	(a) lift and centrifugal force in hover and blade weight negligible				
	(b) flapping, tip path plane and disc area.				
	Flapping angles of the blade in forward flight			x	x
	Forces on the blade in forward flight without cyclic feathering:			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) aerodynamic forces on the advancing and retreating blades without cyclic feathering;				
	(b) periodic forces and stresses, fatigue and flapping hinge;				
	(c) phase lag between the force and the flapping angle (about 90°);				
	(d) flapping motion of the hinged blades and tilting of the cone and flap back of rotor;				
	(e) rotor disc attitude and thrust vector tilt.				
	Cyclic pitch (feathering) in helicopter mode, forward flight:			x	x
	(a) necessity of forward rotor disc tilt and thrust vector tilt;				
	(b) flapping and tip path plane, virtual rotation axis or no flapping axis and plane of rotation;				
	(c) shaft axis and hub plane;				
	(d) cyclic pitch change (feathering) and rotor thrust vector tilt;				
	(e) collective pitch change, collective lever, swash plate, pitch link and pitch horn;				
	(f) cyclic stick, rotating swash plate and pitch link movement and phase angle.				
	Blade lag motion			x	x
	Forces on the blade in the disc plane (tip path plane) in forward flight:			x	x
	(a) forces due to the Coriolis effect because of the flapping;				
	(b) alternating stresses and the need of the drag or lag hinge.				
	The drag or lag hinge:			x	x
	(a) the drag hinge in the fully articulated rotor;				
	(b) the lag flexure in the hinge less rotor;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(c) drag dampers.				
	Ground resonance:			x	x
	(a) blade lag motion and movement of the centre of gravity of the blades and the rotor;				
	(b) oscillating force on the fuselage;				
	(c) fuselage, undercarriage and resonance.				
	Rotor systems			x	x
	See-saw or teetering rotor			x	x
	Fully articulated rotor:			x	x
	(a) three hinges arrangement;				
	(b) bearings and elastomeric hinges.				
	Hinge less rotor and bearing less rotor			x	x
	Blade sailing:			x	x
	(a) low rotor RPM and effect of adverse wind;				
	(b) minimising the danger;				
	(c) droop stops.				
	Vibrations due to main rotor:			x	x
	(a) origins of the vibrations: in plane and vertical;				
	(b) blade tracking and balancing.				
	Tail rotors			x	x
	Conventional tail rotor			x	x
	Rotor description:			x	x
	(a) two-blades tail rotors with teetering hinge;				
	(b) rotors with more than two blades;				
	(c) feathering bearings and flapping hinges;				
	(d) dangers to people and to the tail rotor, rotor height and safety.				
	Aerodynamics:			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) induced airflow and tail rotor thrust;				
	(b) thrust control by feathering, tail rotor drift and roll;				
	(c) effect of tail rotor failure and vortex ring.				
	The fenestron: technical lay-out			x	x
	The NOTAR: technical lay-out			x	x
	Vibrations: high frequency vibrations due to the tail rotors			x	x
	Equilibrium, stability and control			x	x
	Equilibrium and helicopter attitudes			x	x
	Hover: (a) forces and equilibrium conditions;			x	x
	(b) helicopter pitching moment and pitch angle;				
	(c) helicopter rolling moment and roll angle.				
	Forward flight: (a) forces and equilibrium conditions;			x	x
	(b) helicopter moments and angles;				
	(c) effect of speed on fuselage attitude.				
	Control			x	x
	Control power			x	x
	(a) fully articulated rotor;				
	(b) hinge less rotor;				
	(c) teetering rotor.				
	Static and dynamic roll over			x	x
	Helicopter performances				
	Engine performances			x	x
	Piston engines:			x	x
	(a) power available;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) effects of density altitude.				
	Turbine engines:			x	x
	(a) power available;				
	(b) effects of ambient pressure and temperature.				
	Helicopter performances			x	x
	Hover and vertical flight:			x	x
	(a) power required and power available;				
	(b) OGE and IGE maximum hover height;				
	(c) influence of AUM, pressure, temperature and density.				
	Forward flight:			x	x
	(a) maximum speed;				
	(b) maximum rate of climb speed;				
	(c) maximum angle of climb speed;				
	(d) range and endurance;				
	(e) influence of AUM, pressure, temperature and density.				
	Manoeuvring:			x	x
	(a) load factor;				
	(b) bank angle and number of g's;				
	(c) manoeuvring limit load factor.				
	Special conditions:			x	x
	(a) operating with limited power;				
	(b) over pitch and over torque.				

		Aeroplane		**Helicopter**	
		PPL	Bridge course	PPL	Bridge course
6.	**OPERATIONAL PROCEDURES**				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	General				
	Operation of aircraft: ICAO Annex 6, General requirements				
	Definitions	x	x	x	x
	Applicability	x	x	x	x
	Special operational procedures and hazards (general aspects)	x	x	x	x
	Noise abatement				
	Noise abatement procedures	x	x	x	x
	Influence of the flight procedure (departure, cruise and approach)	x	x	x	x
	Runway incursion awareness (meaning of surface markings and signals)	x	x	x	x
	Fire or smoke				
	Carburettor fire	x	x	x	x
	Engine fire	x	x	x	x
	Fire in the cabin and cockpit, (choice of extinguishing agents according to fire classification and use of the extinguishers)	x	x	x	x
	Smoke in the cockpit and (effects and action to be taken) and smoke in the cockpit and cabin (effects and actions taken)	x	x	x	x
	Windshear and microburst				
	Effects and recognition during departure and approach	x	x	x	x
	Actions to avoid and actions taken during encounter	x	x	x	x
	Wake turbulence				
	Cause	x	x	x	x
	List of relevant parameters	x	x	x	x
	Actions taken when crossing traffic, during take-off and landing	x	x	x	x
	Emergency and precautionary landings				
	Definition	x	x	x	x
	Cause	x	x	x	x
	Passenger information	x	x	x	x
	Evacuation	x	x	x	x
	Action after landing	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Contaminated runways				
	Kinds of contamination	x	x		
	Estimated surface friction and friction coefficient	x	x		
	Rotor downwash			x	x
	Operation influence by meteorological conditions (helicopter)				
	White out, sand or dust			x	x
	Strong winds			x	x
	Mountain environment			x	x
	Emergency procedures				
	Influence by technical problems				
	Engine failure			x	x
	Fire in cabin, cockpit or engine			x	x
	Tail, rotor or directional control failure			x	x
	Ground resonance			x	x
	Blade stall			x	x
	Settling with power (vortex ring)			x	x
	Overpitch			x	x
	Overspeed: rotor or engine			x	x
	Dynamic rollover			x	x
	Mast bumping			x	x

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
7.	**FLIGHT PERFORMANCE AND PLANNING**				
7.1.	**MASS AND BALANCE: AEROPLANES OR HELICOPTERS**				
	Purpose of mass and balance considerations				
	Mass limitations				
	Importance in regard to structural limitations	x	x	x	x
	Importance in regard to performance limitations	x	x	x	x
	CG limitations				

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
	Importance in regard to stability and controllability	x	x	x	x
	Importance in regard to performance	x	x	x	x
	Loading				
	Terminology				
	Mass terms	x	x	x	x
	Load terms (including fuel terms)	x	x	x	x
	Mass limits				
	Structural limitations	x	x	x	x
	Performance limitations	x	x	x	x
	Baggage compartment limitations	x	x	x	x
	Mass calculations				
	Maximum masses for take-off and landing	x	x	x	x
	Use of standard masses for passengers, baggage and crew	x	x	x	x
	Fundamentals of CG calculations				
	Definition of centre of gravity	x	x	x	x
	Conditions of equilibrium (balance of forces and balance of moments)	x	x	x	x
	Basic calculations of CG	x	x	x	x
	Mass and balance details of aircraft				
	Contents of mass and balance documentation				
	Datum and moment arm	x	x	x	x
	CG position as distance from datum	x	x	x	x
	Extraction of basic mass and balance data from aircraft documentation				
	BEM	x	x	x	x
	CG position or moment at BEM	x	x	x	x
	Deviations from standard configuration	x	x	x	x
	Determination of CG position				
	Methods				
	Arithmetic method	x	x	x	x
	Graphic method	x	x	x	x
	Load and trim sheet				
	General considerations	x	x	x	x

		Aeroplane	**Helicopter**		
		PPL	Bridge course	PPL	Bridge course
	Load sheet and CG envelope for light aeroplanes and for helicopters	x	x	x	x
7.2.	**PERFORMANCE: AEROPLANES**				
	Introduction				
	Performance classes	x	x		
	Stages of flight	x	x		
	Effect of aeroplane mass, wind, altitude, runway slope and runway conditions	x	x		
	Gradients	x	x		
	SE aeroplanes				
	Definitions of terms and speeds	x	x		
	Take-off and landing performance				
	Use of aeroplane flight manual data	x	x		
	Climb and cruise performance				
	Use of aeroplane flight data	x	x		
	Effect of density altitude and aeroplane mass	x	x		
	Endurance and the effects of the different recommended power or thrust settings	x	x		
	Still air range with various power or thrust settings	x	x		
7.3.	**FLIGHT PLANNING AND FLIGHT MONITORING**				
	Flight planning for VFR flights				
	VFR navigation plan				
	Routes, airfields, heights and altitudes from VFR charts	x	x	x	x
	Courses and distances from VFR charts	x	x	x	x
	Aerodrome charts and aerodrome directory	x	x	x	x
	Communications and radio navigation planning data	x	x	x	x
	Completion of navigation plan	x	x	x	x
	Fuel planning				
	General knowledge	x	x	x	x
	Pre-flight calculation of fuel required				
	Calculation of extra fuel	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Completion of the fuel section of the navigation plan (fuel log) and calculation of total fuel	x	x	x	x
	Pre-flight preparation				
	AIP and NOTAM briefing				
	Ground facilities and services	x	x	x	x
	Departure, destination and alternate aerodromes	x	x	x	x
	Airway routings and airspace structure	x	x	x	x
	Meteorological briefing				
	Extraction and analysis of relevant data from meteorological documents	x	x	x	x
	ICAO flight plan (ATS flight plan)				
	Individual flight plan				
	Format of flight plan	x	x	x	x
	Completion of the flight plan	x	x	x	x
	Submission of the flight plan	x	x	x	x
	Flight monitoring and in-flight re-planning				
	Flight monitoring				
	Monitoring of track and time	x	x	x	x
	In-flight fuel management	x	x	x	x
	In-flight re-planning in case of deviation from planned data	x	x	x	x
7.4.	**PERFORMANCE: HELICOPTERS**				
	General				
	Introduction				
	Stages of flight			x	x
	Effect on performance of atmospheric, airport or heliport and helicopter conditions			x	x
	Applicability of airworthiness requirements			x	x
	Definitions and terminology			x	x
	Performance: SE helicopters				
	Definitions of terms			x	x
	(a) masses;				
	(b) velocities: v_x, v_y;				

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
	(c) velocity of best range and of maximum endurance;				
	(d) power limitations;				
	(e) altitudes.				
	Take-off, cruise and landing performance **Use and interpretation of diagrams and tables:**			x	x
	(a) Take-off:				
	(1) take-off run and distance available;				
	(2) take-off and initial climb;				
	(3) effects of mass, wind and density altitude;				
	(4) effects of ground surface and gradient.				
	(b) Landing:				
	(1) effects of mass, wind, density altitude and approach speed;				
	(2) effects of ground surface and gradient.				
	(c) In-flight:				
	(1) relationship between power required and power available;				
	(2) performance diagram;				
	(3) effects of configuration, mass, temperature and altitude;				
	(4) reduction of performance during climbing turns;				
	(5) autorotation;				
	(6) adverse effects (icing, rain and condition of the airframe).				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
8.	AIRCRAFT GENERAL KNOWLEDGE				
8.1.	AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT				
	System design, loads, stresses, maintenance				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Loads and combination loadings applied to an aircraft's structure	x	x	x	x
	Airframe				
	Wings, tail surfaces and control surfaces				
	Design and constructions	x	x		
	Structural components and materials	x	x		
	Stresses	x	x		
	Structural limitations	x	x		
	Fuselage, doors, floor, wind-screen and windows				
	Design and constructions	x	x	x	x
	Structural components and materials	x	x	x	x
	Stresses	x	x	x	x
	Structural limitations	x	x	x	x
	Flight and control surfaces				
	Design and constructions			x	x
	Structural components and materials			x	x
	Stresses and aero elastic vibrations			x	x
	Structural limitations			x	x
	Hydraulics				
	Hydromechanics: basic principles	x	x	x	x
	Hydraulic systems	x	x	x	x
	Hydraulic fluids: types and characteristics, limitations	x	x	x	x
	System components: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Landing gear, wheels, tyres and brakes				
	Landing gear				
	Types and materials	x	x	x	x
	Nose wheel steering: design and operation	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Brakes				
	Types and materials	x	x	x	x
	System components: design, operation, indications and warnings	x	x	x	x
	Wheels and tyres				
	Types and operational limitations	x	x	x	x
	Helicopter equipments			x	x
	Flight controls				
	Mechanical or powered	x	x	x	x
	Control systems and mechanical	x	x	x	x
	System components: design, operation, indications and warnings, degraded modes of operation and jamming	x	x	x	x
	Secondary flight controls				
	System components: design, operation, degraded modes of operation, indications and warnings	x	x		
	Anti-icing systems				
	Types and operation (pitot and windshield)	x	x	x	x
	Fuel system				
	Piston engine				
	System components: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Turbine engine				
	System components: design, operation, degraded modes of operation, indications and warnings			x	x
	Electrics				
	Electrics: general and definitions				
	Direct current: voltage, current, resistance, conductivity, Ohm's law, power and work	x	x	x	x
	Alternating current: voltage, current, amplitude, phase, frequency and resistance	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Circuits: series and parallel	x	x	x	x
	Magnetic field: effects in an electrical circuit	x	x	x	x
	Batteries				
	Types, characteristics and limitations	x	x	x	x
	Battery chargers, characteristics and limitations	x	x	x	x
	Static electricity: general				
	Basic principles	x	x	x	x
	Static dischargers	x	x	x	x
	Protection against interference	x	x	x	x
	Lightning effects	x	x	x	x
	Generation: production, distribution and use				
	DC generation: types, design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	AC generation: types, design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Electric components				
	Basic elements: basic principles of switches, circuit-breakers and relays	x	x	x	x
	Distribution				
	General: (a) bus bar, common earth and priority; (b) AC and DC comparison.	x	x	x	x
	Piston engines				
	General				
	Types of internal combustion engine: basic principles and definitions	x	x	x	x
	Engine: design, operation, components and materials	x	x	x	x
	Fuel				
	Types, grades, characteristics and limitations	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Alternate fuel: characteristics and limitations	x	x	x	x
	Carburettor or injection system				
	Carburettor: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Injection: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Icing	x	x	x	x
	Air cooling systems				
	Design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Lubrication systems				
	Lubricants: types, characteristics and limitations	x	x	x	x
	Design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Ignition circuits				
	Design, operation, degraded modes of operation	x	x	x	x
	Mixture				
	Definition, characteristic mixtures, control instruments, associated control levers and indications	x	x	x	x
	Propellers				
	Definitions and general: (a) aerodynamic parameters; (b) types; (c) operating modes.	x	x		
	Constant speed propeller: design, operation and system components	x	x		
	Propeller handling: associated control levers, degraded modes of operation, indications and warnings	x	x		
	Performance and engine handling				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Performance: influence of engine parameters, influence of atmospheric conditions, limitations and power augmentation systems	x	x	x	x
	Engine handling: power and mixture settings during various flight phases and operational limitations	x	x	x	x
	Turbine engines				
	Definitions			x	x
	Coupled turbine engine: design, operation, components and materials			x	x
	Free turbine engine: design, operation, components and materials			x	x
	Fuel				
	Types, characteristics and limitations			x	x
	Main engine components				
	Compressor: (a) types, design, operation, components and materials; (b) stresses and limitations; (c) stall, surge and means of prevention.			x	x
	Combustion chamber: (a) types, design, operation, components and materials; (b) stresses and limitations; (c) emission problems.			x	x
	Turbine: (a) types, design, operation, components and materials; (b) stresses, creep and limitations.			x	x
	Exhaust: (a) design, operation and materials; (b) noise reduction.			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Fuel control units: types, operation and sensors			x	x
	Helicopter air intake: different types, design, operation, materials and optional equipments			x	x
	Additional components and systems				
	Helicopter additional components and systems: lubrication system, ignition circuit, starter, accessory gearbox, free wheel units: design, operation and components			x	x
	Performance aspects				
	Torque, performance aspects, engine handling and limitations: (a) engine ratings; (b) engine performance and limitations; (c) engine handling.			x	x
	Protection and detection systems				
	Fire detection systems				
	Operation and indications			x	X
	Miscellaneous systems				
	Rotor design			x	x
	Rotor heads				
	Main rotor				
	Types			x	x
	Structural components and materials, stresses and structural limitations			x	x
	Design and construction			x	x
	Adjustment			x	x
	Tail rotor				
	Types			x	x
	Structural components and materials, stresses and structural limitations			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Design and construction			x	x
	Adjustment			x	x
	Transmission				
	Main gear box				
	Different types, design, operation and limitations			x	x
	Rotor brake				
	Different types, design, operation and limitations			x	x
	Auxiliary systems			x	x
	Drive shaft and associated installation			x	x
	Intermediate and tail gear box				
	Different types, design, operation and limitations			x	x
	Blades				
	Main rotor blade				
	Design and construction			x	x
	Structural components and materials			x	x
	Stresses			x	x
	Structural limitations			x	x
	Adjustment			x	x
	Tip shape			x	x
	Tail rotor blade				
	Design and construction			x	x
	Structural components and materials			x	x
	Stresses			x	x
	Structural limitations			x	x
	Adjustment			x	x
8.2.	INSTRUMENTATION				
	Instrument and indication systems				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Pressure gauge				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Temperature sensing				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Fuel gauge				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Flow meter				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Position transmitter				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Torque meter				
	Design, operation, characteristics and accuracy			x	x
	Tachometer				
	Design, operation, characteristics and accuracy	x	x	x	x
	Measurement of aerodynamic parameters				
	Pressure measurement				
	Static pressure, dynamic pressure, density and definitions	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Temperature measurement: aeroplane				
	Design, operation, errors and accuracy	x	x		
	Displays	x	x		
	Temperature measurement: helicopter				
	Design, operation, errors and accuracy			x	x
	Displays			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Altimeter				
	Standard atmosphere	x	x	x	x
	The different barometric references (QNH, QFE and 1013.25)	x	x	x	x
	Height, indicated altitude, true altitude, pressure altitude and density altitude	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Vertical speed indicator				
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Air speed indicator				
	The different speeds IAS, CAS, TAS: definition, usage and relationships	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Magnetism: direct reading compass				
	Earth magnetic field	x	x	x	x
	Direct reading compass				
	Design, operation, data processing, accuracy and deviation	x	x	x	x
	Turning and acceleration errors	x	x	x	x
	Gyroscopic instruments				
	Gyroscope: basic principles				
	Definitions and design	x	x	x	x
	Fundamental properties	x	x	x	x
	Drifts	x	x	x	x
	Turn and bank indicator				
	Design, operation and errors	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Attitude indicator				
	Design, operation, errors and accuracy	x	x	x	x
	Directional gyroscope				
	Design, operation, errors and accuracy	x	x	x	x
	Communication systems				
	Transmission modes: VHF, HF and SATCOM				
	Principles, bandwidth, operational limitations and use	x	x	x	x
	Voice communication				
	Definitions, general and applications	x	x	x	x
	Alerting systems and proximity systems				
	Flight warning systems				
	Design, operation, indications and alarms	x	x	x	x
	Stall warning				
	Design, operation, indications and alarms	x	x		
	Radio-altimeter				
	Design, operation, errors, accuracy and indications			x	x
	Rotor or engine over speed alert system				
	Design, operation, displays and alarms			x	x
	Integrated instruments: electronic displays				
	Display units				
	Design, different technologies and limitations	x	x	x	x

		Aeroplane		**Helicopter**	
		PPL	Bridge course	PPL	Bridge course
9.	**NAVIGATION**				
9.1.	**GENERAL NAVIGATION**				
	Basics of navigation				
	The solar system				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Seasonal and apparent movements of the sun	x		x	
	The earth				
	Great circle, small circle and rhumb line	x		x	
	Latitude and difference of latitude	x		x	
	Longitude and difference of longitude	x		x	
	Use of latitude and longitude co-ordinates to locate any specific position	x		x	
	Time and time conversions				
	Apparent time	x		x	
	UTC	x		x	
	LMT	x		x	
	Standard times	x		x	
	Dateline	x		x	
	Definition of sunrise, sunset and civil twilight	x		x	
	Directions				
	True north, magnetic north and compass north	x		x	
	Compass deviation	x		x	
	Magnetic poles, isogonals, relationship between true and magnetic	x		x	
	Distance				
	Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres and ft	x		x	
	Conversion from one unit to another	x		x	
	Relationship between nautical miles and minutes of latitude and minutes of longitude	x		x	
	Magnetism and compasses				
	General principles				
	Terrestrial magnetism	x		x	
	Resolution of the earth's total magnetic force into vertical and horizontal components	x		x	
	Variation-annual change	x		x	
	Aircraft magnetism				
	The resulting magnetic fields	x		x	
	Keeping magnetic materials clear of the compass	x		x	
	Charts				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	General properties of miscellaneous types of projections				
	Direct Mercator	x		x	
	Lambert conformal conic	x		x	
	The representation of meridians, parallels, great circles and rhumb lines				
	Direct Mercator	x		x	
	Lambert conformal conic	x		x	
	The use of current aeronautical charts				
	Plotting positions	x		x	
	Methods of indicating scale and relief (ICAO topographical chart)	x		x	
	Conventional signs	x		x	
	Measuring tracks and distances	x		x	
	Plotting bearings and distances	x		x	
	DR navigation				
	Basis of DR				
	Track	x		x	
	Heading (compass, magnetic and true)	x		x	
	Wind velocity	x		x	
	Air speed (IAS, CAS and TAS)	x		x	
	Groundspeed	x		x	
	ETA	x		x	
	Drift and wind correction angle	x		x	
	DR position fix	x		x	
	Use of the navigational computer				
	Speed	x		x	
	Time	x		x	
	Distance	x		x	
	Fuel consumption	x		x	
	Conversions	x		x	
	Air speed	x		x	
	Wind velocity	x		x	
	True altitude	x		x	
	The triangle of velocities				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Heading	x		x	
	Ground speed	x		x	
	Wind velocity	x		x	
	Track and drift angle	x		x	
	Measurement of DR elements				
	Calculation of altitude	x		x	
	Determination of appropriate speed	x		x	
	In-flight navigation				
	Use of visual observations and application to in-flight navigation	x		x	
	Navigation in cruising flight, use of fixes to revise navigation data				
	Ground speed revision	x		x	
	Off-track corrections	x		x	
	Calculation of wind speed and direction	x		x	
	ETA revisions	x		x	
	Flight log	x		x	
9.2.	**RADIO NAVIGATION**				
	Basic radio propagation theory				
	Antennas				
	Characteristics	x		x	
	Wave propagation				
	Propagation with the frequency bands	x		x	
	Radio aids				
	Ground DF				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	NDB/ADF				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	VOR				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	DME				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	Radar				
	Ground radar				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	Secondary surveillance radar and transponder				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Modes and codes	x		x	
	GNSS				
	GPS, GLONASS OR GALILEO				
	Principles	x		x	
	Operation	x		x	
	Errors and accuracy	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Factors affecting accuracy	x		x	

AMC2 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE PPL(AS)

The following table contains the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the PPL(As). The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated to the licence and the activity.

		PPL
1.	**AIR LAW AND ATC PROCEDURES**	
	International law: conventions, agreements and organisations	x
	Airworthiness of aircraft	x
	Aircraft nationality and registration marks	x
	Personnel licensing	x
	Rules of the air	x
	Procedures for air navigation services: aircraft operations	x
	Air traffic services and air traffic management	x
	Aeronautical information service	x
	Aerodromes	x
	Search and rescue	x
	Security	x
	Aircraft accident and incident investigation	x
	National law	x

		PPL
2.	**HUMAN PERFORMANCE**	
	Human factors: basic concepts	x
	Basic aviation physiology and health maintenance	x
	Basic aviation psychology	x

		PPL
3.	**METEOROLOGY**	
	The atmosphere	x
	Wind	x

	Thermodynamics	x
	Clouds and fog	x
	Precipitation	x
	Air masses and fronts	x
	Pressure systems	x
	Climatology	x
	Flight hazards	x
	Meteorological information	x

		PPL
4.	**COMMUNICATIONS**	
	VFR COMMUNICATIONS	
	Definitions	x
	General operating procedures	x
	Relevant weather information terms (VFR)	x
	Action required to be taken in case of communication failure	x
	Distress and urgency procedures	x
	General principles of VHF propagation and allocation of frequencies	x

		PPL
5.	**PRINCIPLES OF FLIGHT**	
	Basics of aerostatics	x
	Basics of subsonic aerodynamics	x
	Aerodynamics of airships	x
	Stability	x
	Controllability	x
	Limitations	x
	Propellers	x
	Basics of airship flight mechanics	x

		PPL
6.	**OPERATIONAL PROCEDURES**	
	General requirements	x
	Special operational procedures and hazards (general aspects)	x
	Emergency procedures	x

		PPL
7.	**FLIGHT PERFORMANCE AND PLANNING**	
7.1	**MASS AND BALANCE**	
	Purpose of mass and balance considerations	x
	Loading	x
	Fundamentals of CG calculations	x
	Mass and balance details of aircraft	x
	Determination of CG position	x
	Passenger, cargo and ballast handling	x
7.2	**PERFORMANCE**	
	Airworthiness requirements	x
	Basics of airship performance	x
	Definitions and terms	x
	Stages of flight	x
	Use of flight manual	x
7.3	**FLIGHT PLANNING AND FLIGHT MONITORING**	
	Flight planning for VFR flights	x
	Fuel planning	x
	Pre-flight preparation	x
	ATS flight plan	x
	Flight monitoring and in-flight re-planning	x

		PPL
8.	**AIRCRAFT GENERAL KNOWLEDGE**	
8.1	**ENVELOPE, AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**	
	Design, materials, loads and stresses	x
	Envelope and airbags	x
	Framework	x
	Gondola	x
	Flight controls	x
	Landing gear	x
	Hydraulics and pneumatics	x
	Heating and air conditioning	x
	Fuel system	x
	Piston engines (propellers)	x

	Turbine engines (basics)	x
	Electrics	x
	Fire protection and detection systems	x
	Maintenance	x
8.2	**INSTRUMENTATION**	
	Sensors and instruments	x
	Measurement of air data and gas parameters	x
	Magnetism: direct reading compass and flux valve	x
	Gyroscopic instruments	x
	Communication systems	x
	Alerting systems	x
	Integrated instruments: electronic displays	x
	Flight management system (general basics)	x
	Digital circuits and computers	x

		PPL
9.	**NAVIGATION**	
9.1.	**GENERAL NAVIGATION**	
	Basics of navigation	x
	Magnetism and compasses	x
	Charts	x
	DR navigation	x
	In-flight navigation	x
9.2.	**RADIO NAVIGATION**	
	Basic radio propagation theory	x
	Radio aids	x
	Radar	x
	GNSS	x

AMC3 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE BPL AND SPL

The syllabi for the theoretical knowledge instruction and examination for the LAPL(B) and LAPL(S) in AMC1 FCL.115 and FCL.120 should be used for the BPL and SPL, respectively.

FCL.215 Theoretical knowledge examination

Applicants for a BPL, SPL or PPL shall demonstrate a level of theoretical knowledge appropriate to the privileges granted through examinations in the following subjects:

(a) common subjects:

— Air law,

— Human performance,

— Meteorology, and

— Communications;

(b) specific subjects concerning the different aircraft categories:

— Principles of flight,

— Operational procedures,

— Flight performance and planning,

— Aircraft general knowledge, and

— Navigation.

AMC1 FCL.210; FCL.215

AMC2 FCL.210; FCL.215

AMC3 FCL.210; FCL.215

AMC1 FCL.215; FCL.235

THEORETICAL KNOWLEDGE EXAMINATION AND SKILL TEST FOR THE PPL

(a) Theoretical knowledge examination

(1) The examinations should comprise a total of 120 multiple-choice questions covering all the subjects.

(2) Communication practical classroom testing may be conducted.

(3) The period of 18 months mentioned in FCL.025(b)(2) should be counted from the end of the calendar month when the applicant first attempted an examination.

(b) Skill test

Further training may be required following any failed skill test or part thereof. There should be no limit to the number of skill tests that may be attempted.

(c) Conduct of the test

(1) If the applicant chooses to terminate a skill test for reasons considered inadequate by the FE, the applicant should retake the entire skill test. If the test is terminated for reasons considered adequate by the FE, only those sections not completed should be tested in a further flight.

(2) Any manoeuvre or procedure of the test may be repeated once by the applicant. The FE may stop the test at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest.

(3) An applicant should be required to fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

FCL.235 Skill test

(a) Applicants for a BPL, SPL or PPL shall demonstrate through the completion of a skill test the ability to perform, as PIC on the appropriate aircraft category, the relevant procedures and manoeuvres with competency appropriate to the privileges granted.

(b) An applicant for the skill test shall have received flight instruction on the same class or type of aircraft, or a group of balloons to be used for the skill test.

(c) Pass marks

(1) The skill test shall be divided into different sections, representing all the different phases of flight appropriate to the category of aircraft flown.

(2) Failure in any item of a section will cause the applicant to fail the entire section. If the applicant fails only 1 section, he/she shall repeat only that section. Failure in more than 1 section will cause the applicant to fail the entire test.

(3) When the test needs to be repeated in accordance with (2), failure in any section, including those that have been passed on a previous attempt, will cause the applicant to fail the entire test.

(4) Failure to achieve a pass in all sections of the test in 2 attempts will require further training.

AMC1 FCL.125; FCL.235

AMC2 FCL.125; FCL.235

AMC1 FCL.235 Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A PPL(A)

(a) The route to be flown for the navigation test should be chosen by the FE. The route may end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should have a duration that allows the pilot to demonstrate his/her ability to complete a route with at least three identified waypoints and may, as agreed between the applicant and FE, be flown as a separate test.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the authorised checklist for the aeroplane on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the aeroplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the aeroplane used:

(1) height:

(i) normal flight	± 150 ft
(ii) with simulated engine failure	± 200 ft (if ME aeroplane is used)

(2) heading or tracking of radio aids:

(i) normal flight	± 10 °
(ii) with simulated engine failure	± 15 ° (if ME aeroplane is used)

(3) speed:

(i) take-off and approach	+15/–5 knots
(ii) all other flight regimes	± 15 knots

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(A) on SE and ME aeroplanes or on TMGs.

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE

Use of checklist, airmanship, control of aeroplane by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Pre-flight documentation, NOTAM and weather briefing
b	Mass and balance and performance calculation
c	Aeroplane inspection and servicing
d	Engine starting and after starting procedures
e	Taxiing and aerodrome procedures, pre-take-off procedures
f	Take-off and after take-off checks
g	Aerodrome departure procedures
h	ATC compliance and R/T procedures
SECTION 2 GENERAL AIRWORK	
a	ATC compliance and R/T procedures
b	Straight and level flight, with speed changes
c	Climbing: i. best rate of climb; ii. climbing turns; iii. levelling off.
d	Medium (30 ° bank) turns
e	Steep (45 ° bank) turns (including recognition and recovery from a spiral dive)
f	Flight at critically low air speed with and without flaps
g	Stalling: i. clean stall and recover with power; ii. approach to stall descending turn with bank angle 20°, approach configuration; iii. approach to stall in landing configuration.
h	Descending: i. with and without power; ii. descending turns (steep gliding turns);

	iii. levelling off.
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed
c	Orientation, timing and revision of ETAs and log keeping
d	Diversion to alternate aerodrome (planning and implementation)
e	Use of radio navigation aids
f	Basic instrument flying check (180 ° turn in simulated IMC)
g	Flight management (checks, fuel systems and carburettor icing, etc.)
h	ATC compliance and R/T procedures
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures
b	* Precision landing (short field landing), crosswind, if suitable conditions available
c	* Flapless landing
d	* Approach to landing with idle power (SE only)
e	Touch and go
f	Go-around from low height
g	ATC compliance and R/T procedures
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (SE only)
b	* Simulated forced landing (SE only)
c	Simulated precautionary landing (SE only)

d	Simulated emergencies
e	Oral questions
SECTION 6 SIMULATED ASYMMETRIC FLIGHT AND RELEVANT CLASS OR TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in an FFS)
b	Asymmetric approach and go-around
c	Asymmetric approach and full stop landing
d	Engine shutdown and restart
e	ATC compliance, R/T procedures or airmanship
f	As determined by the FE: any relevant items of the class or type rating skill test to include, if applicable: i. aeroplane systems including handling of auto pilot; ii. operation of pressurisation system; iii. use of de-icing and anti-icing system.
g	Oral questions

* These items may be combined, at the discretion of the FE.

AMC2 FCL.235 Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A PPL(H)

(a) The area and route to be flown should be chosen by the FE and all low level and hover work should be at an adequate aerodrome or site. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test, as set out in this AMC should consist of at least three legs, each leg of a minimum duration of 10 minutes. The skill test may be conducted in two flights.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the authorised checklist or pilot operating handbook for the helicopter on which the test is being taken. During pre-flight preparation for the test the applicant is required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the helicopter used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the helicopter within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgement and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the helicopter used.

(1) height:

(I) normal forward flight ± 150 ft

(ii) with simulated major emergency ± 200 ft

(iii) hovering IGE flight ± 2 ft

(2) heading or tracking of radio aids:

(i) normal flight ± 10 °

(ii) with simulated major emergency ± 15 °

(3) speed:

(i) take-off approach – 10 knots/+15 knots

(ii) all other flight regimes ± 15 knots

(4) ground drift:

(i) take-off hover IGE ± 3 ft

(ii) landing no sideways or
backwards movement

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(H) on SE or ME helicopters.

SECTION 1 PRE-FLIGHT OR POST-FLIGHT CHECKS AND PROCEDURES
Use of checklist, airmanship, control of helicopter by external visual reference, anti-icing procedures, etc. apply in all sections

a	Helicopter knowledge, (for example technical log, fuel, mass and balance, performance), flight planning, NOTAM and weather briefing
b	Pre-flight inspection or action, location of parts and purpose
c	Cockpit inspection and starting procedure
d	Communication and navigation equipment checks, selecting and setting frequencies
e	Pre-take-off procedure, R/T procedure and ATC compliance
f	Parking, shutdown and post-flight procedure
SECTION 2 HOVER MANOEUVRES, ADVANCED HANDLING AND CONFINED AREAS	
a	Take-off and landing (lift-off and touch down)
b	Taxi and hover taxi
c	Stationary hover with head, cross or tail wind
d	Stationary hover turns, 360 ° left and right (spot turns)
e	Forward, sideways and backwards hover manoeuvring
f	Simulated engine failure from the hover
g	Quick stops into and downwind
h	Sloping ground or unprepared sites landings and take-offs
i	Take-offs (various profiles)
j	Crosswind and downwind take-off (if practicable)
k	Take-off at maximum take-off mass (actual or simulated)
l	Approaches (various profiles)
m	Limited power take-off and landing
n	Autorotations, (FE to select two items from: basic, range, low speed and 360 ° turns)
o	Autorotative landing
p	Practice forced landing with power recovery

q	Power checks, reconnaissance technique, approach and departure technique
SECTION 3 NAVIGATION - EN ROUTE PROCEDURES	
a	Navigation and orientation at various altitudes or heights and map reading
b	Altitude or height, speed, heading control, observation of airspace and altimeter setting
c	Monitoring of flight progress, flight log, fuel usage, endurance, ETA, assessment of track error and re-establishment of correct track and instrument monitoring
d	Observation of weather conditions and diversion planning
e	Use of navigation aids (where available)
f	ATC liaison with due observance of regulations, etc.
SECTION 4 FLIGHT PROCEDURES AND MANOEUVRES	
a	Level flight, control of heading, altitude or height and speed
b	Climbing and descending turns to specified headings
c	Level turns with up to 30 ° bank, 180 ° to 360 ° left and right
d	Level turns 180 ° left and right by sole reference to instruments
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES (SIMULATED WHERE APPROPRIATE)	
Note (1) Where the test is conducted on an ME helicopter, a simulated engine failure drill, including an SE approach and landing should be included in the test.	
Note (2) The FE should select four items from the following:	
a	Engine malfunctions, including governor failure, carburettor or engine icing and oil system, as appropriate
b	Fuel system malfunction
c	Electrical system malfunction
d	Hydraulic system malfunction, including approach and landing without hydraulics, as applicable
e	Main rotor or anti-torque system malfunction (FFS or discussion only)
f	Fire drills, including smoke control and removal, as applicable

	g	Other abnormal and emergency procedures as outlined in an appropriate flight manual and with reference to Appendix 9 C to Part-FCL, sections 3 and 4, including for ME helicopters: (a) Simulated engine failure at take-off: (1) rejected take-off at or before TDP or safe forced landing at or before DPATO; (2) shortly after TDP or DPATO. (b) Landing with simulated engine failure: (1) landing or go-around following engine failure before LDP or DPBL; (2) following engine failure after LDP or safe forced landing after DPBL.

AMC3 FCL.235 Skill test

CONTENT OF THE SKILL TEST FOR THE ISSUE OF THE PPL(AS)

(a) The area and route to be flown is chosen by the FE. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome and one destination should be a controlled aerodrome. The skill test may be conducted in two flights. The total duration of the flight(s) should be at least 60 minutes.

(b) The applicant should demonstrate the ability to:

(1) operate the airship within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgement and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the airship at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

Flight test tolerances

(c) The following limits should apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the airship used.

(1) height:

(i) normal flight ±200 ft

(ii) simulated major emergency ±300 ft

(2) tracking on radio aids: ±15 °

(3) heading:

(i) normal flight ±15 °

(ii) simulated major emergency ±20 °

CONTENT OF THE TEST

(d) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(As).

(e) Items in sections 5 and 6 may be performed in an FNPT (As) or a FS (As).

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of airship checklists, airmanship, control of airship by external visual reference, anti-icing procedures, and principles of threat and error management, etc. apply in all sections	
a	Pre-flight, including: flight planning, documentation, mass and balance, NOTAM and weather briefing
b	Airship inspection and servicing
c	Off-mast procedure, ground manoeuvring and take-off
d	Performance considerations and trim
e	Aerodrome and traffic pattern operations
f	Departure procedure, altimeter setting, collision avoidance (look-out)
g	ATC compliance and R/T procedures
SECTION 2 GENERAL AIRWORK	
a	Control of the airship by external visual reference, including straight and level, climb, descent and look-out
b	Flight close to pressure height
c	Turns
d	Steep descents and climbs
e	Flight by reference solely to instruments, including: i. Level flight, control of heading, altitude and air speed; ii. Climbing and descending turns; iii. Recoveries from unusual attitudes.
f	ATC compliance and R/T procedures
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed and collision avoidance (look-out procedures)
c	Orientation, timing and revision of ETAs and log keeping
d	Observation of weather conditions and diversion to alternate aerodrome (planning and implementation)
e	Use of radio navigation aids
f	Flight management (checks, fuel systems, etc.)

g	ATC compliance and R/T procedures
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures, altimeter setting, checks and look-out
b	ATC compliance and R/T procedures
c	Go-around action
d	Normal landing
e	Short field landing
f	Post-flight actions
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (at a safe altitude) and fire drill
b	Equipment malfunctions
c	Forced landing (simulated)
d	ATC compliance and R/T procedures
e	Oral questions
SECTION 6 RELEVANT TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in a FFS)
b	Approach and go-around with failed engine(s)
c	Approach and full stop landing with failed engine(s)
d	Malfunctions in the envelope pressure system
e	ATC compliance, R/T procedures and airmanship
f	As determined by the FE: any relevant items of the type rating skill test to include, if applicable: i. Airship systems; ii. Operation of envelope pressure system.
g	Oral questions

Go back to Subpart C
Go back to the content

SECTION 2 - Specific requirements for the PPL aeroplanes — PPL(A)

FCL.205.A PPL(A) — Privileges

(a) The privileges of the holder of a PPL(A) are to act without remuneration as PIC or co-pilot on aeroplanes or TMGs engaged in non-commercial operations.

(b) Notwithstanding the paragraph above, the holder of a PPL(A) with instructor or examiner privileges may receive remuneration for:

(1) the provision of flight instruction for the LAPL(A) or PPL(A);

(2) the conduct of skill tests and proficiency checks for these licences;

(3) the training, testing and checking for the ratings or certificates attached to this licence.

FCL.210.A PPL(A) — Experience requirements and crediting

(a) Applicants for a PPL(A) shall have completed at least 45 hours of flight instruction in aeroplanes or TMGs, 5 of which may have been completed in an FSTD, including at least:

(1) 25 hours of dual flight instruction; and

(2) 10 hours of supervised solo flight time, including at least 5 hours of solo cross-country flight time with at least 1 cross-country flight of at least 270 km (150 NM), during which full stop landings at 2 aerodromes different from the aerodrome of departure shall be made.

(b) Specific requirements for applicants holding an LAPL(A). Applicants for a PPL(A) holding an LAPL(A) shall have completed at least 15 hours of flight time on aeroplanes after the issue of the LAPL(A), of which at least 10 shall be flight instruction completed in a training course at an ATO. This training course shall include at least 4 hours of supervised solo flight time, including at least 2 hours of solo cross-country flight time with at least 1 cross-country flight of at least 270 km (150 NM), during which full stop landings at 2 aerodromes different from the aerodrome of departure shall be made.

(c) Specific requirements for applicants holding an LAPL(S) with a TMG extension. Applicants for a PPL(A) holding an LAPL(S) with a TMG extension shall have completed:

(1) at least 24 hours of flight time on TMG after the endorsement of the TMG extension; and

(2) 15 hours of flight instruction in aeroplanes in a training course at an ATO, including at least the requirements of (a)(2).

(d) Crediting. Applicants holding a pilot licence for another category of aircraft, with the exception of balloons, shall be credited with 10 % of their total flight time as PIC on such aircraft up to a maximum of 10 hours. The amount of credit given shall in any case not include the requirements in (a)(2).

AMC1 FCL.210.A PPL(A) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(A)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The PPL(A) flight instruction syllabus takes into account the principles of threat and error management and also covers:

(i) pre-flight operations, including mass and balance determination, aircraft inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at critically low air speeds, recognition of, and recovery from, incipient and full stalls;

(v) flight at critically high air speeds, recognition of, and recovery from, spiral dive;

(vi) normal and crosswind take-offs and landings;

(vii) maximum performance (short field and obstacle clearance) take-offs, short-field landings;

(viii) flight by reference solely to instruments, including the completion of a level 180 ° turn;

(ix) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(x) emergency operations, including simulated aeroplane equipment malfunctions;

(xi) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(A) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the aeroplane.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the aeroplane:

(A) characteristics of the aeroplane;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and aeroplane acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) harness, seat or rudder panel adjustments;

(G) starting and warm-up checks;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing (for example tie down);

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects when laterally level and when banked;

(B) further effects of aileron and rudder;

(C) effects of:

(a) air speed;

(b) slipstream;

(c) power;

(d) trimming controls;

(e) flaps;

(f) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5a: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures.

(vii) Exercise 5b: Emergencies: brake and steering failure.

(viii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance and trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(x) Exercise 8: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(xi) Exercise 9: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (for example in correct pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) faults in the turns (slipping and skidding on suitable types);

(G) turns onto selected headings, use of gyro heading indicator and compass;

(H) use of instruments for precision.

(xii) Exercise 10a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the aeroplane in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xiii) Exercise 10b: Stalling:

(A) safety checks;

(B) symptoms;

(C) recognition;

(D) clean stall and recovery without power and with power;

(E) recovery when a wing drops;

(F) approach to stall in the approach and in the landing configurations, with and without power and recovery at the incipient stage.

(xiv) Exercise 11: Spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45 °);

(C) instructor induced distractions during the stall.

Note 1: at least two hours of stall awareness and spin avoidance flight training should be completed during the course.

Note 2: consideration of manoeuvre limitations and the need to refer to the aeroplane manual and mass and balance calculations.

(xv) Exercise 12: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel;

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure/techniques including performance calculations;

(G) noise abatement procedures.

(xvi) Exercise 13: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel;

(D) effect of wind on approach and touchdown speeds and use of flaps;

(E) crosswind approach and landing;

(F) glide approach and landing;

(G) short landing and soft field procedures or techniques;

(H) flapless approach and landing;

(I) wheel landing (tail wheel aeroplanes);

(J) missed approach and go-around;

(K) noise abatement procedures.

(xvii) Exercise 12/13: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety it will be necessary for pilots trained on nose wheel aeroplanes to undergo dual conversion training before flying tail wheel aeroplanes, and vice-versa.

(xviii) Exercise 14: First solo:

(A) instructor's briefing, observation of flight and de-briefing;

Note: during flights immediately following the solo circuit consolidation the following should be revised:

(B) procedures for leaving and rejoining the circuit;

(C) the local area, restrictions, map reading;

(D) use of radio aids for homing;

(E) turns using magnetic compass, compass errors.

(xix) Exercise 15: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xx) Exercise 16: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine cooling;

(G) engine failure checks;

(H) use of radio;

(I) base leg;

(J) final approach;

(K) landing;

(L) actions after landing.

(xxi) Exercise 17: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xxii) Exercise 18a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) controlled airspace;

(3) danger, prohibited and restricted areas;

(4) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) mass and performance.

(d) flight information:

(1) NOTAMs etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) aeroplane documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in controlled or regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of altitude and heading;

(d) revisions of ETA and heading;

(e) log keeping;

(f) use of radio;

(g) use of navaids;

(h) minimum weather conditions for continuation of flight;

(i) in-flight decisions;

(j) transiting controlled or regulated airspace;

(k) diversion procedures;

(l) uncertainty of position procedure;

(m) lost procedure.

(C) arrival and aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of aeroplane;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xxiii) Exercise 18b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxiv) Exercise 18c: Radio navigation:

(A) use of GNSS:

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF omni range:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP, frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME:

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xxv) Exercise 19: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation; attitude instrument flight;

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level at various air speeds and configurations;

(b) climbing and descending;

(c) standard rate turns, climbing and descending, onto selected headings;

(d) recoveries from climbing and descending turns.

(d) BITD

(1) A BITD may be used for flight training for:

(i) flight by reference solely to instruments;

(ii) navigation using radio navigation aids;

(iii) basic instrument flight.

(2) The use of the BITD should be subject to the following:

(i) the training should be complemented by exercises on an aeroplane;

(ii) the record of the parameters of the flight must be available;

(iii) A FI(A) or STI(A) should conduct the instruction.

SECTION 3 - Specific requirements for the PPL helicopters — PPL(H)

FCL.205.H PPL(H) — Privileges

(a) The privileges of the holder of a PPL(H) are to act without remuneration as PIC or co-pilot of helicopters engaged in non-commercial operations.

(b) Notwithstanding the paragraph above, the holder of a PPL(H) with instructor or examiner privileges may receive remuneration for:

(1) the provision of flight instruction for the LAPL(H) or the PPL(H);

(2) the conduct of skill tests and proficiency checks for these licences;

(3) the training, testing and checking for the ratings and certificates attached to this licence.

FCL.210.H PPL(H) — Experience requirements and crediting

(a) Applicants for a PPL(H) shall have completed at least 45 hours of flight instruction on helicopters, 5 of which may have been completed in an FNPT or FFS, including at least:

(1) 25 hours of dual flight instruction; and

(2) 10 hours of supervised solo flight time, including at least 5 hours of solo cross-country flight time with at least 1 cross-country flight of at least 185 km (100 NM), with full stop landings at 2 aerodromes different from the aerodrome of departure.

(3) 35 of the 45 hours of flight instruction have to be completed on the same type of helicopter as the one used for the skill test.

(b) Specific requirements for an applicant holding an LAPL(H). Applicants for a PPL(H) holding an LAPL(H) shall complete a training course at an ATO. This training course shall include at least 5 hours of dual flight instruction time and at least 1 supervised solo cross-country flight of at least 185 km (100 NM), with full stop landings at 2 aerodromes different from the aerodrome of departure.

(c) Applicants holding a pilot licence for another category of aircraft, with the exception of balloons, shall be credited with 10 % of their total flight time as PIC on such aircraft up to a maximum of 6 hours. The amount of credit given shall in any case not include the requirements in (a)(2).

AMC1 FCL.210.H PPL(H) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(H)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Ground instruction

Enhanced ground instruction in weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conducting a precautionary landing.

(c) Flight instruction

(1) The PPL(H) flight instruction syllabus should take into account the principles of threat and error management and cover:

(i) pre-flight operations, including mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic autorotations, simulated engine failure, ground resonance recovery if relevant to type;

(vi) sideways and backwards flight, turns on the spot;

(vii) incipient vortex ring recognition and recovery;

(viii) touchdown autorotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(ix) steep turns;

(x) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(xi) limited power and confined area operations, including selection of and operations to and from unprepared sites;

(xii) flight by sole reference to basic flight instruments, including completion of a level 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud (this training may be conducted by an FI(H));

(xiii) cross-country flying by using visual reference, DR, GNNS and, where available, radio navigation aids; simulation of deteriorating weather conditions and actions to divert or conduct precautionary landing;

(xiv) operations to, from and transiting controlled aerodromes; compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(H) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(3) Wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

(d) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the helicopter.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the helicopter:

(A) characteristics of the helicopter, external features;

(B) cockpit layout;

(C) systems;

(D) checklists, procedures and controls.

(ii) Exercise 1b: Emergency procedures:

(A) action if fire on the ground and in the air;

(B) engine, cabin and electrical system fire;

(C) systems failures;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and helicopter acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) seat, harness and flight controls adjustments;

(G) starting and warm-up checks clutch engagement and starting rotors;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing;

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience:

(A) to introduce the student to rotary wing flight;

(B) flight exercise.

(v) Exercise 4: Effects of controls:

(A) function of flight controls, primary and secondary effect;

(B) effects of:

(a) air speed;

(b) power changes (torque);

(c) yaw (sideslip);

(d) disc loading (bank and flare);

(e) controls of selecting hydraulics on/off;

(f) control friction.

(C) instruments;

(D) use of carburettor heat or anti-icing control.

(vi) Exercise 5: Power and attitude changes:

(A) relationship between cyclic control position, disc attitude, fuselage attitude and air speed;

(B) flapback;

(C) power required diagram in relation to air speed;

(D) power and air speed changes in level flight;

(E) use of instruments for precision;

(F) engine and air speed limitations.

(vii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) control in pitch, including use of control friction or trim;

(C) maintaining direction and balance, (ball or yawstring use);

(D) setting power for selected air speeds and speed changes;

(E) use of instruments for precision.

(viii) Exercise 7: Climbing:

(A) optimum climb speed, best angle or rate of climb from power required diagram;

(B) initiation, maintaining the normal and maximum rate of climb, levelling off;

(C) levelling off at selected altitudes or heights;

(D) use of instruments for precision.

(ix) Exercise 8: Descending:

(A) optimum descent speed, best angle or rate of descent from power required diagram;

(B) initiation, maintaining and levelling off;

(C) levelling off at selected altitudes or heights;

(D) descent (including effect of power and air speed);

(E) use of instruments for precision.

(x) Exercise 9: Turning:

(A) initiation and maintaining medium level turns;

(B) resuming straight flight;

(C) altitude, bank and co-ordination;

(D) climbing and descending turns and effect on rate of climb or descent;

(E) turns onto selected headings, use of gyro heading indicator and compass;

(F) use of instruments for precision.

(xi) Exercise 10: Basic autorotation:

(A) safety checks, verbal warning and look-out;

(B) entry, development and characteristics;

(C) control of air speed and RRPM, rotor and engine limitations;

(D) effect of AUM, IAS, disc loading, G forces and density altitude;

(E) re-engagement and go-around procedures (throttle over-ride or ERPM control);

(F) vortex condition during recovery;

(G) gentle and medium turns in autorotation;

(H) demonstration of variable flare simulated engine off landing.

(xii) Exercise 11a: Hovering:

(A) demonstrate hover IGE, importance of wind effect and attitude, ground cushion, stability in the hover and effects of over controlling;

(B) student holding cyclic stick only;

(C) student handling collective lever (and throttle) only;

(D) student handling collective lever, (throttle) and pedals;

(E) student handling all controls;

(F) demonstration of ground effect;

(G) demonstration of wind effect;

(H) demonstrate gentle forward running touchdown;

(I) specific hazards for example snow, dust and litter.

(xiii) Exercise 11b: Hover taxiing and spot turns:

(A) revise hovering;

(B) precise ground speed and height control;

(C) effect of wind direction on helicopter attitude and control margin;

(D) control and co-ordination during spot turns;

(E) carefully introduce gentle forward running touchdown.

(xiv) Exercise 11c: Hovering and taxiing emergencies:

(A) revise hovering and gentle forward running touchdown, explain (demonstrate where applicable) effect of hydraulics failure in the hover;

(B) demonstrate simulated engine failure in the hover and hover taxi;

(C) demonstrate dangers of mishandling and over-pitching.

(xv) Exercise 12: Take-off and landing:

(A) pre-take-off checks or drills;

(B) look-out;

(C) lifting to hover;

(D) after take-off checks;

(E) danger of horizontal movement near ground;

(F) danger of mishandling and overpitching;

(G) landing (without sideways or backwards movement);

(H) after landing checks or drills;

(I) take-off and landing crosswind and downwind.

(xvi) Exercise 13: Transitions from hover to climb and approach to hover:

(A) look-out;

(B) revise take-off and landing;

(C) ground effect, translational lift and its effects;

(D) flapback and its effects;

(E) effect of wind speed and direction during transitions from or to the hover;

(F) the constant angle approach;

(G) demonstration of variable flare simulated engine off landing.

(xvii) Exercise 14a: Circuit, approach and landing:

(A) revise transitions from hover to climb and approach to hover;

(B) circuit procedures, downwind and base leg;

(C) approach and landing with power;

(D) pre-landing checks;

(E) effect of wind on approach and IGE hover;

(F) crosswind approach and landing;

(G) go-around;

(H) noise abatement procedures.

(xviii) Exercise 14b: Steep and limited power approaches and landings:

(A) revise the constant angle approach;

(B) the steep approach (explain danger of high sink rate and low air speed)

(C) limited power approach (explain danger of high speed at touch down);

(D) use of the ground effect;

(E) variable flare simulated engine off landing.

(xix) Exercise 14c: Emergency procedures:

(A) abandoned take-off;

(B) missed approach and go-around;

(C) hydraulic off landing (if applicable);

(D) tail rotor control or tail rotor drive failure (briefing only)

(E) simulated emergencies in the circuit to include:

(a) hydraulics failure;

(b) simulated engine failure on take-off, crosswind, downwind and base leg;

(c) governor failure.

(xx) Exercise 15: First solo:

(A) instructor’s briefing, observation of flight and debriefing;

(B) warn of change of attitude from reduced and laterally displaced weight;

(C) warn of low tail, low skid or wheel during hover, landing;

(D) warn of dangers of loss of RRPM and overpitching;

(E) pre-take-off checks;

(F) into wind take-off;

(G) procedures during and after take-off;

(H) normal circuit, approaches and landings;

(I) action if an emergency.

(xxi) Exercise 16: Sideways and backwards hover manoeuvring:

(A) manoeuvring sideways flight heading into wind;

(B) manoeuvring backwards flight heading into wind;

(C) combination of sideways and backwards manoeuvring;

(D) manoeuvring sideways and backwards and heading out of wind;

(E) stability and weather cocking;

(F) recovery from backwards manoeuvring (pitch nose down);

(G) limitations for sideways and backwards manoeuvring.

(xxii) Exercise 17: Spot turns:

(A) revise hovering into wind and downwind;

(B) turn on spot through 360º:

(a) around pilots position;

(b) around tail rotor;

(c) around helicopter geometric centre;

(d) square and safe visibility clearing turn.

(C) rotor RPM control, torque effect, cyclic limiting stops due to CG position and wind speed and direction.

(xxiii) Exercise 18: Hover OGE and vortex ring:

(A) establishing hover OGE;

(B) drift, height or power control;

(C) demonstration of incipient stage of vortex ring, recognition and recovery (from a safe altitude);

(D) loss of tail rotor effectiveness.

(xxiv) Exercise 19: Simulated EOL:

(A) the effect of weight, disc loading, density attitude and RRPM decay;

(B) revise basic autorotation entry;

(C) optimum use of cyclic and collective to control speed or RRPM;

(D) variable flare simulated EOL;

(E) demonstrate constant attitude simulated EOL;

(F) demonstrate simulated EOL from hover or hover taxi;

(G) demonstrate simulated EOL from transition and low level.

(xxv) Exercise 20: Advanced autorotation:

(A) over a selected point at various height and speed;

(B) revise basic autorotation: note ground distance covered;

(C) range autorotation;

(D) low speed autorotation;

(E) constant attitude autorotation (terminate at safe altitude);

(F) 'S' turns;

(G) turns through 180 ° and 360 °;

(H) effects on angles of descent, IAS, RRPM and effect of AUM.

(xxvi) Exercise 21: Practice forced landings:

(A) procedure and choice of the forced landing area;

(B) forced landing checks and crash action;

(C) re-engagement and go-around procedures.

(xxvii) Exercise 22: Steep turns:

(A) steep (level) turns (30 ° bank);

(B) maximum rate turns (45 ° bank if possible);

(C) steep autorotative turns;

(D) faults in the turn: balance, attitude, bank and co-ordination;

(E) RRPM control and disc loading;

(F) vibration and control feedback;

(G) effect of wind at low level.

(xxviii) Exercise 23: Transitions:

(A) revise ground effect, translational lift and flapback;

(B) maintaining constant height, (20-30 ft AGL);

(C) transition from hover to minimum 50 knots IAS and back to hover;

(D) demonstrate effect of wind.

(xxix) Exercise 24: Quick stops:

(A) use of power and controls;

(B) effect of wind;

(C) quick stops into wind;

(D) quick stops from crosswind and downwind terminating into wind;

(E) danger of vortex ring;

(F) danger of high disc loading.

(xxx) Exercise 25a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation and use;

(1) choice of route:

(2) controlled airspace, danger and prohibited areas;

(3) safety altitudes and noise abatement considerations.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate landing sites.

(e) helicopter documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form (where appropriate).

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in controlled or regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of height or altitude and heading;

(d) revisions of ETA and heading:

(1) 10 ° line, double track and track error and closing angle;

(2) 1 in 60 rule;

(3) amending an ETA.

(e) log keeping;

(f) use of radio;

(g) use of navaids (if fitted);

(h) minimum weather conditions for continuation of flight;

(i) in-flight decisions;

(j) transiting controlled or regulated airspace;

(k) uncertainty of position procedure;

(l) lost procedure.

(C) arrival and aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures.

(e) parking;

(f) security of helicopter;

(g) refuelling;

(h) closing of flight plan (if appropriate);

(i) post-flight administrative procedures.

(xxxi) Exercise 25b: Navigation problems at low heights and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and other aircraft);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) avoidance of noise sensitive areas;

(F) actions in the event of encountering DVE;

(G) decision to divert or conduct precautionary landing;

(H) bad weather circuit and landing;

(I) appropriate procedures and choice of landing area;

(J) precautionary landing.

(xxxii) Exercise 25c: Radio navigation:

(A) use of GNSS:

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages;

(d) hazards of over-reliance on the use of GNSS in the continuation of flight in DVE.

(B) use of VHF omni range:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) RTF procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilots responsibilities;

(d) secondary surveillance radar (if transponder fitted):

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME:

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xxxiii) Exercise 26: Advanced take-off, landings and transitions:

(A) landing and take-off out of wind (performance reduction);

(B) ground effect, translational lift and directional stability variation when out of wind;

(C) downwind transitions;

(D) vertical take-off over obstacles;

(E) running take-off;

(F) cushion creep take-off;

(G) reconnaissance of landing site;

(H) running landing;

(I) zero speed landing;

(J) crosswind and downwind landings;

(K) steep approach;

(L) go-around.

(xxxiv) Exercise 27: Sloping ground:

(A) limitations and assessing slope angle;

(B) wind and slope relationship: blade and control stops;

(C) effect of CG when on slope;

(D) ground effect on slope and power required;

(E) right skid up slope;

(F) left skid up slope;

(G) nose up slope;

(H) avoidance of dynamic roll over, dangers of soft ground and sideways movement on touchdown;

(I) danger of striking main or tail rotor by harsh control movement near ground.

(xxxv) Exercise 28: Limited power:

(A) take-off power check;

(B) vertical take-off over obstacles;

(C) in-flight power check;

(D) running landing;

(E) zero speed landing;

(F) approach to low hover;

(G) approach to hover;

(H) approach to hover OGE;

(I) steep approach;

(J) go-around.

(xxxvi) Exercise 29: Confined areas:

(A) landing capability and performance assessment;

(B) locating landing site and assessing wind speed and direction;

(C) reconnaissance of landing site;

(D) select markers;

(E) select direction and type of approach;

(F) circuit;

(G) approach to committed point and go-around;

(H) approach;

(I) clearing turn;

(J) landing;

(K) power check and performance assessment in and out of ground effect;

(L) normal take-off to best angle of climb speed;

(M) vertical take-off from hover.

(xxxvii) Exercise 30: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation:

(a) attitude instrument flight;

(b) instrument scan.

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level at various air speeds and configurations;

(b) climbing and descending;

(c) standard rate turns, climbing and descending, onto selected headings.

(E) recoveries from climbing and descending turns;

(F) recoveries from unusual attitudes.

(xxxviii) Exercise 31a: Night flying (if night rating required):

(A) pre-flight inspection using torch, pan lights, etc.;

(B) take-off (no sideways or backwards manoeuvring);

(C) hover taxi (higher and slower than by day);

(D) transition to climb;

(E) level flight;

(F) approach and transition to hover;

(G) landing;

(H) autorotation;

(I) practice forced landing (with flares if appropriate: simulated);

(J) night emergencies (for example failure of lights, etc.).

(xxxix) Exercise 31b: Night cross-country (if night rating required):

(A) navigation principles as for day cross-country;

(B) map marking (highlighting built-up areas with thicker lines, etc.).

SECTION 4 - Specific requirements for the PPL airships — PPL(As)

FCL.205.As PPL(As) — Privileges

(a) The privileges of the holder of a PPL(As) are to act without remuneration as PIC or co-pilot on airships engaged in non-commercial operations.

(b) Notwithstanding the paragraph above, the holder of a PPL(As) with instructor or examiner privileges may receive remuneration for:

(1) the provision of flight instruction for the PPL(As);

(2) the conduct of skill tests and proficiency checks for this licence;

(3) the training, testing and checking for the ratings or certificates attached to this licence.

FCL.210.As PPL(As) — Experience requirements and crediting

(a) Applicants for a PPL(As) shall have completed at least 35 hours of flight instruction in airships, 5 of which may have been completed in an FSTD, including at least:

(1) 25 hours of dual flight instruction, including:

(i) 3 hours of cross-country flight training, including 1 cross-country flight of at least 65 km (35 NM);

(ii) 3 hours of instrument instruction;

(2) 8 take-offs and landings at an aerodrome, including masting and unmasting procedures;

(3) 8 hours of supervised solo flight time.

(b) Applicants holding a BPL and qualified to fly hot-air airships shall be credited with 10 % of their total flight time as PIC on such airships up to a maximum of 5 hours.

AMC1 FCL.210.As PPL(As) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(AS)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The PPL(As) flight instruction syllabus should take into account the principles of threat and error management and cover:

(i) pre-flight operations, including mass and balance determination, airship inspection and servicing;

(ii) ground manoeuvring, masting and unmasting procedures;

(iii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iv) control of the airship by external visual reference;

(v) take-offs and landings;

(vi) flight by reference solely to instruments, including the completion of a level 180 ° turn;

(vii) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(viii) emergency operations, including simulated airship equipment malfunctions;

(ix) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(As) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the airship.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the airship:

(A) characteristics of the airship;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and airship acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) mass and balance;

(E) external checks;

(F) ground crew briefing;

(G) internal checks;

(H) harness, seat or rudder panel adjustments;

(I) starting and warm-up checks;

(J) power checks;

(K) running down system checks and switching off the engine;

(L) parking, security and masting;

(M) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects;

(B) further effects;

(C) effects of:

(a) air speed;

(b) power;

(c) trimming controls;

(d) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5: Ground manoeuvring:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) masting procedures;

(E) control of direction and turning;

(F) effects of wind;

(G) effects of ground surface;

(H) marshalling signals;

(I) instrument checks;

(J) air traffic control procedures;

(K) emergencies.

(vii) Exercise 6a: Take-off procedures:

(A) pre-take-off checks;

(B) take-off with different static heaviness;

(C) drills during and after take-off;

(D) noise abatement procedures.

(viii) Exercise 6b: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) malfunctions of thrust vector control;

(D) aerodynamic control failures;

(E) electrical and system failures.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) maximum angle of climb;

(D) maximum rate of climb.

(x) Exercise 8: Straight and level:

(A) attaining and maintaining straight and level flight;

(B) flight at or close to pressure height;

(C) control in pitch, including use of trim;

(D) at selected air speeds (use of power);

(E) during speed changes;

(F) use of instruments for precision.

(xi) Exercise 9: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) maximum rate of descent;

(D) maximum angle of descent;

(E) use of instruments for precision flight.

(xii) Exercise 10: Turning:

(A) entry and maintaining level turns;

(B) resuming straight flight;

(C) faults in the turn;

(D) climbing turns;

(E) descending turns;

(F) turns onto selected headings, use of gyro heading indicator and compass;

(G) use of instruments for precision.

(xiii) Exercise 11: Hovering: hovering manoeuvres (as applicable);

(xiv) Exercise 12a: Approach and landing:

(A) effect of wind on approach and touchdown speeds;

(B) landing with different static heaviness;

(C) missed approach and go-around procedures;

(D) noise abatement procedures.

(xv) Exercise 12b: Emergencies:

(A) aborted approach or go-around;

(B) malfunction of thrust vector control;

(C) envelope emergencies;

(D) fire emergencies;

(E) aerodynamic control failures;

(F) electrical and system failures.

(xvi) Exercise 13: Precautionary landing:

(A) occasions necessitating;

(B) in-flight conditions;

(C) landing area selection;

(D) circuit and approach;

(E) actions after landing;

(xvii) Exercise 14a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) sensitive areas;

(4) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) performance.

(d) flight information:

(1) NOTAMs etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) airship documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in controlled or regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of altitude and heading;

(d) revisions of ETA and heading;

(e) log keeping;

(f) use of radio;

(g) use of navaids;

(h) minimum weather conditions for continuation of flight;

(i) in-flight decisions;

(j) transiting controlled or regulated airspace;

(k) diversion procedures;

(l) uncertainty of position procedure;

(m) lost procedure.

(C) arrival, aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking or on masting;

(f) security of airship;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xviii) Exercise 14b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles, and terrain);

(C) difficulties of map reading;

(D) effects of winds, turbulence and precipitation;

(E) vertical situational awareness;

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xix) Exercise 14c: Radio navigation:

(A) use of GNSS

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF omni range (if applicable):

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs (if applicable):

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot’s responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME (if applicable);

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xx) Exercise 15: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation: attitude instrument flight;

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level;

(b) climbing and descending;

(c) turns, climbing and descending, onto selected headings;

(d) recoveries from climbing and descending turns.

(d) BITD

(1) A BITD may be used for flight training for:

(i) flight by reference solely to instruments;

(ii) navigation using radio navigation aids;

(iii) basic instrument flight.

(2) The use of the BITD should be subject to the following:

(i) the training should be complemented by exercises on an airship;

(ii) the record of the parameters of the flight must be available; and an FI(As) should conduct the instruction.

SECTION 5 - Specific requirements for the sailplane pilot licence (SPL)

FCL.205.S SPL — Privileges and conditions

(a) The privileges of the holder of an SPL are to act as PIC on sailplanes and powered sailplanes. In order to exercise the privileges on a TMG, the holder shall have to comply with the requirements in FCL.135.S.

(b) Holders of an SPL shall:

(1) carry passengers only when having completed, after the issuance of the licence, at least 10 hours of flight time or 30 launches as PIC on sailplanes or powered sailplanes;

(2) be restricted to act without remuneration in non-commercial operations until they have:

(i) attained the age of 18 years;

(ii) completed, after the issuance of the licence, 75 hours of flight time or 200 launches as PIC on sailplanes or powered sailplanes;

(iii) passed a proficiency check with an examiner.

(c) Notwithstanding (b)(2), the holder of an SPL with instructor or examiner privileges may receive remuneration for:

(1) the provision of flight instruction for the LAPL(S) or the SPL;

(2) the conduct of skill tests and proficiency checks for these licences;

(3) the training, testing and checking for the ratings and certificates attached to these licences.

AMC1 FCL.135.S; FCL.205.S

AMC1 FCL.205.S(b) SPL — Privileges and conditions

CONTENTS OF THE PROFICIENCY CHECK FOR THE EXTENSION OF SPL PRIVILEGES TO EXERCISE COMMERCIAL PRIVILEGES ON A SAILPLANE

(a) The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the authorised checklist for the sailplane on which the test is being taken.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the sailplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the sailplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The applicant should demonstrate his/her skill in at least the winch or aerotow method of launching.

SECTION 1 PRE-FLIGHT OPERATIONS AND TAKE-OFF	
Use of checklist, airmanship, control of sailplane by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight sailplane (daily) inspection, documentation, NOTAM and weather briefing
b	Verifying in-limits mass and balance and performance calculation
c	Passenger briefing
d	Sailplane servicing compliance
e	Pre-take-off checks
SECTION 2 LAUNCH METHOD Note: at least for one of the three launch methods all the mentioned items are fully exercised during the skill test.	
SECTION 2 (a) WINCH OR CAR LAUNCH	
a	Signals before and during launch, including messages to winch driver
b	Initial roll and take-off climb
c	Adequate profile of winch launch
d	Launch failures (simulated)
e	Situational awareness
SECTION 2 (b) AEROTOW LAUNCH	
a	Signals before and during launch, including signals to or communications with tow plane pilot for any problems
b	Initial roll and take-off climb
c	Launch abandonment (simulation only or ‘talk-through’)
d	Correct positioning during straight flight and turns
e	Out of position and recovery
f	Correct release from tow
g	Lookout and airmanship through whole launch phase
SECTION 2 (c) SELF LAUNCH (TMGs excluded)	

a	ATC compliance
b	Aerodrome departure procedures
c	Initial roll and take-off climb
d	Simulated engine failure after take-off
e	Engine shut down and stowage
f	Lookout and airmanship through whole launch phase
SECTION 3 GENERAL AIRWORK	
a	Maintain straight flight: attitude and speed control
b	Steep (45 ° bank) turns, look-out procedures and collision avoidance
c	Turning on to selected headings visually and with use of compass
d	Flight at high angle of attack (critically low air speed)
e	Clean stall and recovery
f	Spin avoidance and recovery
g	Local area navigation and awareness
SECTION 4 CIRCUIT, APPROACH AND LANDING	
a	Aerodrome circuit joining procedure
b	Collision avoidance: look-out procedures
c	Pre-landing checks
d	Circuit, approach control and landing
e	Precision landing (simulation of out-landing: short field)
f	Cross wind landing if suitable conditions available

FCL.210.S SPL — Experience requirements and crediting

(a) Applicants for an SPL shall have completed at least 15 hours of flight instruction on sailplanes or powered sailplanes, including at least the requirements specified in FCL.110.S.

(b) Applicants for an SPL holding an LAPL(S) shall be fully credited towards the requirements for the issue of an SPL.

Applicants for an SPL who held an LAPL(S) within the period of 2 years before the application shall be fully credited towards the requirements of theoretical knowledge and flight instruction.

Crediting. Applicants holding a pilot licence for another category of aircraft, with the exception of balloons, shall be credited with 10 % of their total flight time as PIC on such aircraft up to a maximum of 7 hours. The amount of credit given shall in any case not include the requirements in of FCL.110.S(a)(2) to (a)(4).

AMC1 FCL.110.S; FCL.210.S

FCL.220.S SPL — Launch methods

The privileges of the SPL shall be limited to the launch method included in the skill test. This limitation may be removed and the new privileges exercised when the pilot complies with the requirements in FCL.130.S.

FCL.230.S SPL — Recency requirements

Holders of an SPL shall only exercise the privileges of their licence when complying with the recency requirements in FCL.140.S.

SECTION 6 - Specific requirements for the balloon pilot licence (BPL)

FCL.205.B BPL — Privileges and conditions

(a) The privileges of the holder of a BPL are to act as PIC on balloons.

(b) Holders of a BPL shall be restricted to act without remuneration in non- commercial operations until they have:

(1) attained the age of 18 years;

(2) completed 50 hours of flight time and 50 take-offs and landings as PIC on balloons;

(3) passed a proficiency check with an examiner on a balloon in the specific class.

(c) Notwithstanding paragraph (b), the holder of a BPL with instructor or examiner privileges may receive remuneration for:

(1) the provision of flight instruction for the LAPL(B) or the BPL;

(2) the conduct of skill tests and proficiency checks for these licences;

(3) the training, testing and checking for the ratings and certificates attached to these licences.

AMC1 FCL.205.B(b) BPL — Privileges and conditions

CONTENTS OF THE PROFICIENCY CHECK FOR EXTENSION OF BPL PRIVILEGES TO EXERCISE COMMERCIAL PRIVILEGES ON A BALLOON

(a) The take-off site should be chosen by the applicant depending on the actual meteorological conditions, the area which has to be overflown and the possible options for suitable landing sites. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The proficiency check may be conducted in two flights. The total duration of the flight(s) should be at least 60 minutes.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the balloon on which the test is being taken. During pre-flight preparation for the test the applicant should be required to perform crew and passenger briefings and demonstrate crowd control. The load calculation should be performed by the applicant in compliance with the operations manual or flight manual for the balloon used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the balloon within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the balloon at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the hot-air balloon used:

Height

(1) normal flight ± 100 ft

(2) with simulated emergency ± 150 ft

CONTENT OF THE SKILL TEST

(e) The contents and sections of the proficiency check set out in this AMC should be used for the extension of BPL privileges to exercise commercial privileges on a hot-air balloon.

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control and crew briefing
e	Passenger briefing
f	Assembly and layout
g	Inflation and pre-take-off procedures
h	Take-off
i	ATC compliance
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading

b	Marking positions and time
c	Orientation, airspace structure
d	Maintenance of altitude
e	Fuel management
f	Communication with retrieve crew
g	ATC compliance or R/T communication
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level and missed approach and fly on
b	Approach from high level and missed approach and fly on
c	Passenger pre-landing briefing
d	Pre-landing checks
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance or R/T communication
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 6	
a	Simulated fire on the ground and in the air
b	Simulated pilot light and burner failures
c	Simulated passenger health problems
d	Other abnormal and emergency procedures as outlined in the appropriate flight manual
e	Oral questions

(f) The contents and sections of the proficiency check set out in this AMC should be used for the extension of BPL privileges to exercise commercial privileges on a gas balloon.

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF

Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning and NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control and crew briefings
e	Passenger briefing
f	Assembly and layout
g	Inflation and pre-take-off procedures
h	Take-off
i	ATC liaison: compliance
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC liaison: compliance
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation, airspace structure
d	Maintenance of altitude
e	Ballast management
f	Communication with retrieve crew
g	ATC compliance or R/T communication
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level and missed approach and fly on

b	Approach from high level and missed approach and fly on
c	Passenger pre-landing briefing
d	Pre-landing checks
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance or R/T communication
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated closed appendix during take-off and climb
b	Simulated parachute or valve failure
c	Simulated passenger health problems
d	Other abnormal and emergency procedures as outlined in the appropriate flight manual
e	Oral questions

FCL.210.B BPL — Experience requirements and crediting

(a) Applicants for a BPL shall have completed on balloons in the same class and group at least 16 hours of flight instruction, including at least:

(1) 12 hours of dual flight instruction;

(2) 10 inflations and 20 take-offs and landings; and

(3) 1 supervised solo flight with a minimum flight time of at least 30 minutes.

(b) Applicants for a BPL holding an LAPL(B) shall be fully credited towards the requirements for the issue of a BPL.

Applicants for a BPL who held an LAPL(B) within the period of 2 years before the application shall be fully credited towards the requirements of theoretical knowledge and flight instruction.

AMC1 FCL.110.B; FCL.210.B

FCL.220.B BPL — Extension of privileges to tethered flights

The privileges of the BPL shall be limited to non-tethered flights. This limitation may be removed when the pilot complies with the requirements in FCL.130.B.

Go back to Subpart C
Go back to the content

AMC1 FCL.130.B; FCL.220.B

FCL.225.B BPL — Extension of privileges to another balloon class or group

The privileges of the BPL shall be limited to the class and group of balloons in which the skill test was taken. This limitation may be removed when the pilot has:

(a) in the case of an extension to another class within the same group, complied with the requirements in FCL.135.B;

(b) in the case of an extension to another group within the same class of balloons, completed at least:

(1) 2 instruction flights on a balloon of the relevant group; and

(2) the following hours of flight time as PIC on balloons:

(i) for balloons with an envelope capacity between 3 401 m 3 and 6 000 m 3 , at least 100 hours;

(ii) for balloons with an envelope capacity between 6 001 m 3 and 10 500 m 3 , at least 200 hours;

(iii) for balloons with an envelope capacity of more than 10 500 m 3 , at least 300 hours;

(iv) for gas balloons with an envelope capacity of more than 1 260 m 3 , at least 50 hours.

AMC1 FCL.135.B; FCL.225.B

AMC2 FCL.135.B; FCL.225.B

AMC1 FCL.225.B BPL — Extension of privileges to another balloon class or group

(a) The aim of the flight training is to qualify BPL holders to exercise the privileges on a different class or group of balloons.

(b) The following classes should be recognised:

(1) hot-air balloons;

(2) gas balloons;

(3) hot-air airships.

(c) The following groups should be recognised:

(1) group A:

(i) hot-air balloons and hot-air airships with a maximum envelope capacity of 3 400m^3;

(ii) gas balloons with a maximum envelope capacity of 1 260m^3.

(2) group B:

(i) hot-air balloons and hot-air airship with an envelope capacity between 3 401m³ and 6 000m³;

(ii) gas balloons with an envelope capacity of more than 1 260m³.

(3) group C:

hot-air balloons and hot-air airship with an envelope capacity between 6 001m³ and 10 500m³.

(4) group D:

hot-air balloons and hot-air airships with an envelope capacity of more than 10 500m³.

(d) An extension to group B is also valid for group A. The extension for the group C is also valid for the groups A and B. An extension to group D will include the privilege for the other three groups.

(e) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

FCL.230.B BPL — Recency requirements

(a) Holders of a BPL shall only exercise the privileges of their licence when they have completed in one class of balloons in the last 24 months at least:

(1) 6 hours of flight time as PIC, including 10 take-offs and landings; and

(2) 1 training flight with an instructor in a balloon within the appropriate class;

(3) in addition, in the case of pilots qualified to fly more than one class of balloons, in order to exercise their privileges in the other class, they shall have completed at least 3 hours of flight time on that class within the last 24 months, including 3 take-offs and landings.

(b) Holders of a BPL shall only operate a balloon of the same a group of the balloon in which the training flight is completed or a balloon of a group with a smaller envelope size:

(c) Holders of a BPL who do not comply with the requirements in (a) shall, before they resume the exercise of their privileges:

(1) pass a proficiency check with an examiner in a balloon within the appropriate class; or

(2) perform the additional flight time or take-offs and landings, flying dual or solo under the supervision of an instructor, in order to fulfil the requirements in (a).

(d) In the case of (c)(1) the holder of the BPL shall only operate a balloon of the same group of the balloon in which the proficiency check is completed or a balloon of a group with a smaller envelope size.

SUBPART D - COMMERCIAL PILOT LICENCE — CPL

SECTION 1 - Common requirements

FCL.300 CPL — Minimum age

An applicant for a CPL shall be at least 18 years of age.

FCL.305 CPL — Privileges and conditions

(a) Privileges. The privileges of the holder of a CPL are, within the appropriate aircraft category, to:

(1) exercise all the privileges of the holder of an LAPL and a PPL;

(2) act as PIC or co-pilot of any aircraft engaged in operations other than commercial air transport;

(3) act as PIC in commercial air transport of any single-pilot aircraft subject to the restrictions specified in FCL.060 and in this Subpart;

(4) act as co-pilot in commercial air transport subject to the restrictions specified in FCL.060.

(b) Conditions. An applicant for the issue of a CPL shall have fulfilled the requirements for the class or type rating of the aircraft used in the skill test.

FCL.310 CPL — Theoretical knowledge examinations

An applicant for a CPL shall demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

— Air Law,

— Aircraft General Knowledge — Airframe/Systems/Powerplant,

— Aircraft General Knowledge — Instrumentation,

— Mass and Balance,

— Performance,

— Flight Planning and Monitoring,

— Human Performance,

— Meteorology,

— General Navigation,

— Radio Navigation,

— Operational Procedures,

— Principles of Flight,

— Visual Flight Rules (VFR) Communications.

AMC1 FCL.310; FCL.515 (b); FCL.615 (b)

Acceptable Means of Compliance and Guidance Material

to Part-FCL (Learning Objectives (LOs)) — Amendment 2

Learning Objectives (LOs)

Table of contents

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LOs FOR ATPL, CPL AND IR

GENERAL

The detailed theoretical knowledge syllabus outlines the topics that should be taught and examined in order to meet the theoretical knowledge requirements appropriate to ATPL, MPL, CPL and IR.

For each topic in the detailed theoretical knowledge syllabus, one or more LOs are set out in the chapters as shown below.

Reference	***Subject***	***Chapter***

010	***Air law and ATC procedures***	A.
020	***Aircraft general knowledge***	
021	*Airframe and systems, electrics, power plant and emergency equipment*	B.
022	*Instrumentation*	C.
030	***Flight performance and planning***	
031	*Mass and balance*	D.
032	*Performance (Aeroplane)*	E.
033	*Flight planning and monitoring*	F.
034	*Performance (Helicopter)*	G.
040	***Human performance and limitations***	H.
050	***Meteorology***	I.
060	***Navigation***	
061	*General navigation*	J.
062	*Radio navigation*	K.
070	***Operational procedures***	L.
080	***Principles of flight***	
081	*Principles of flight (Aeroplane)*	M.
082	*Principles of flight (Helicopter)*	N.
090	***Communications***	
091	*VFR communications*	O.
092	*IFR communications*	P.

The applicable LOs for each licence or the instrument rating are marked with an 'x'.

The LOs define the theoretical knowledge that a student should have assimilated upon successful completion of an approved theoretical knowledge course prior to undertaking the theoretical knowledge examinations. They refer to measurable statements of the skills and knowledge that a student should be able to demonstrate following a defined element of training.

The LOs are intended to be used by an approved training organisation (ATO) when developing the

Part-FCL theoretical knowledge elements of the appropriate course. It should be noted, however, that the LOs do not provide a ready-made ground-training syllabus for individual ATOs, and should not be seen by organisations as a substitute for thorough course design. Adherence to the LOs should become part of the ATO's compliance monitoring scheme as required by ORA.GEN.200(a)(6). Any consequential changes to the organisation's documentation should not result in an approval process in accordance with ORA.GEN.130(a). In any case, the ATO should remain responsible for ensuring that the respective theoretical knowledge training courses are carried out while taking into account the LOs provided in this AMC.

TRAINING AIMS

After completion of the training, a student should be able to apply the acquired knowledge and skills to:

— understand the capabilities and limitations of the equipment used;

— identify sources of information and analyse information relevant to the operation;

— identify hazards, assess risks and manage threats;

— apply solutions to common problems including errors.

Specific examples of the application of knowledge and skills will be provided in the respective appendix to a subject, if needed.

INTERPRETATION

The abbreviations used are ICAO abbreviations listed in ICAO Doc 8400 'ICAO Abbreviations and Codes', or those listed in GM1 FCL.010.

Where an LO refers to a definition, e.g. 'Define the following terms' or 'Define and understand' or 'Explain the definitions in ...', candidates are also expected to be able to recognise a given definition.

Below is a table showing the short references to legislation and standards:

Reference	**Legislation/Standard**
The Basic Regulation	Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 (as amended)
The Aircrew Regulation	Commission Regulation (EU) No 1178/2011 of 3 November 2011 (as amended)
Part-FCL	Annex I to Commission Regulation (EU) No 1178/ 2011 of 3 November 2011 (as amended)
Part-MED	Annex IV to Commission Regulation (EU) No 1178/ 2011 of 3 November 2011 (as amended)
CS-23, CS-25, CS-27, CS-29, CS-E and CS-Definitions	Refer to the CS parts in Book 1 of the correspondingly numbered EASA Certification Specifications
AMC-23, AMC-25, etc.	Refer to the AMC parts in Book 2 of the correspondingly numbered EASA Certification Specifications
Single European Sky Regulations	Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation) Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation) Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation) Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
Passenger Rights Regulation	Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of

	denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91
RTCA/EUROCAE	*Refers to correspondingly numbered documents* Radio Technical Commission for Aeronautics/European Organisation for Civil Aviation Equipment
ITU Radio Regulation	International Telecommunication Union Radio Regulation
NASA TM-85652	National Aeronautics and Space Administration — Technical Memorandum 85652

'Applicable operational requirements' means Annexes I, II, III, IV and V to Commission Regulation (EU) No 965/2012 of 5 October 2012 (as amended).

The Jeppesen Student Pilots' Training Route Manual (SPTRM), otherwise known as the 'Training Route Manual' (TRM), contains planning data plus aerodrome and approach charts that may be used in theoretical knowledge training courses.

Specimen data manuals, CAP 697 for Aeroplanes and CAP 758 for Helicopters, may be used in training courses and for reference during theoretical knowledge examinations. Where the competent authority does not permit the use of these manuals during examinations, alternative data manuals shall be provided to support the relevant questions. Definitions that are included in these data manuals are explained in the relevant manual.

Some numerical data, e.g. speeds, altitudes/levels and masses, used in questions for theoretical knowledge examinations may not be representative for helicopter operations but the data is satisfactory for the calculations required.

A. SUBJECT 010 — AIR LAW

(1) The subjects 'Air law' and 'ATC procedures' are primarily based on ICAO documentation and European Union regulations.

(2) National law should not be taken into account for theoretical-examination purposes; it should remain relevant though during practical training and operational flying.

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
010 00 00 00	**AIR LAW**						
010 01 00 00	**INTERNATIONAL LAW: CONVENTIONS, AGREEMENTS AND ORGANISATIONS**						
010 01 01 00	**The Convention on International Civil Aviation (Chicago) — ICAO DOC 7300**						
LO	Explain the historical background that led to the establishment of the Convention on International Civil Aviation, Chicago, 7 December 1944.	x	x	x	x	x	

010 01 01 01	**Part I — Air navigation**						
LO	Be familiar with the general contents of relevant parts of the following chapters: general principles and application of the Convention; flight over territory of Contracting States; nationality of aircraft; measures to facilitate air navigation; conditions to be fulfilled with respect to aircraft; international standards and recommended practices (SARPs), especially notification of differences and validity of endorsed certificates and licences.	x	x	x	x	x	
LO	General principles Describe the application of the following terms in civil aviation: sovereignty; territory, high seas, according to the UN Convention on the High Seas.	x	x	x	x	x	
LO	Define the following terms and explain how they apply to international air traffic: right of non-scheduled flight (including the two technical freedoms of the air); scheduled air services; cabotage; landing at customs airports; applicability of air regulations; rules of the air; search of aircraft.	x	x	x	x	x	
LO	Describe the duties of Contracting States in relation to: documents carried on board of the aircraft: certificate of registration; certificates of airworthiness; licences of personnel;	x	x	x	x	x	

	recognition of certificates and licences; cargo restrictions; photographic apparatus.						
010 01 01 02	**Part II — The International Civil Aviation Organization (ICAO)**						
LO	Describe the objectives of ICAO.	x	x	x	x	x	
LO	Explain the organisation and duties of the ICAO Assembly, Council and Air Navigation Commission (ANC).	x	x	x	x	x	
LO	Explain the organisation and duties of the ICAO Headquarters and Regional Offices.	x	x	x	x	x	
LO	Describe the worldwide ICAO regions.	x	x	x	x	x	
LO	Be familiar with the hierarchy of the ICAO publications (SARPs, Docs): annexes to the Convention; documents.	x	x	x	x	x	
010 01 02 00	**Other conventions and agreements**						
010 01 02 01	**The International Air Services Transit Agreement (ICAO Doc 7500)**						
LO	Explain the two technical freedoms of the air.	x	x	x	x	x	
010 01 02 02	**The International Air Transport Agreement**						
LO	Explain the three commercial freedoms of the air.	x	x	x	x	x	
LO	Describe the legal situation within the EU with regard to the Freedoms of the Air.	x	x	x	x	x	
010 01 02 03	**Suppression of unlawful acts against the safety of civil aviation; the Conventions of Tokyo, Den Haag and Montreal**						
LO	Explain the facts that led to the Conventions and Supplements concerning unlawful acts against the safety of civil aviation.	x	x	x	x	x	
LO	Explain the content of the Convention on Unlawful Acts Committed on Board Aircraft.	x	x	x	x	x	

	(Doc 8364 — Convention on Offences and Certain Other Acts Committed on Board Aircraft, Tokyo, 14 September 1963)						
LO	Explain the content of the Convention on Suppression of Unlawful Seizure of Aircraft. (Doc 8920 — Convention for the Suppression of Unlawful Seizure of Aircraft, Den Haag, 16 December 1970, and Protocol for the Suppression of Unlawful Acts against the Safety of Civil Aviation, Montreal, 23 September 1971)	x	x	x	x	x	
LO	Explain the content of the Convention on Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation in accordance with Doc 8966 — Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, done at Montreal on 23 September 1971, and signed at Montreal on 24 February 1988).	x	x	x	x	x	
LO	Describe the measures and actions to be taken by the PIC of an aircraft in order to suppress unlawful acts against the safety of the aircraft. (Doc 9518 — Protocol supplementary to the Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, done at Montreal on 23 September 1971, and signed at Montreal on 24 February 1988)	x	x	x	x	x	
010 01 02 04	**Bilateral agreements**						
LO	Explain the reason for the existence of bilateral agreements for scheduled air transport (Digest of Bilateral Air Transport Agreements, ICAO Doc 9511).	x		x	x		
010 01 02 05	**International private law**						
LO	Explain the Conventions and Protocols designed to cover liability towards persons and goods in accordance with the Warsaw System based on the Convention for the Unification of Certain Rules Relating to International Carriage by Air, Warsaw, 2 October 1929.	x	x	x	x	x	
LO	Explain the legal significance of the issue of a passenger ticket and/or of baggage/cargo documents.	x	x	x	x	x	

LO	Describe the consequences for an airline and/or the PIC when a passenger ticket is not issued.	x	x	x	x	x	
LO	Explain that the liability towards persons and goods may be unlimited on the basis of the Montreal Convention of 28 May 1999.	x	x	x	x	x	
LO	Explain the consequences of the EU Regulation about passenger rights in case of delay, cancellation or denied boarding.	x	x	x	x	x	
LO	Explain the liability limit in relation to destruction, loss, damage or delay of baggage.	x	x	x	x	x	
010 01 02 06	**Operators' and pilots' liabilities towards persons and goods on the ground in case of damage and injury caused by the operation of the aircraft**						
LO	Explain the Conventions and Protocols designed to cover liability towards persons and goods on the ground based on the International Convention for rules relating to Damage Caused by aircraft, signed at Rome on 29 May 1933 and on 7 October 1952, and at Montreal on 23 September 1978.	x	x	x	x	x	
010 01 02 07	**The Convention of Rome (1933) and other documents related to rights in aircraft.**						
LO	Understand the rules relating to international recognition of rights in aircraft and the rules relating to precautionary arrest of aircraft.	x	x	x	x	x	
010 01 03 00	**World organisations**						
010 01 03 01	**The International Air Transport Association (IATA)**						
LO	Describe the general organisation and objectives of IATA.	x		x	x		
010 01 04 00	**European organisations**						
010 01 04 01	**European Aviation Safety Agency (EASA)**						
LO	Describe the general organisation and objectives of EASA.	x	x	x	x	x	
LO	Describe the role of EASA in European civil aviation.	x	x	x	x	x	
LO	Describe the role of the National Aviation Authorities (NAAs) in relation to EASA.	x	x	x	x	x	

LO	Give an overview of the EASA Regulations' structure.	x	x	x	x	x	
LO	Describe the relationship between EASA, ICAO and other organisations.	x	x	x	x	x	
010 01 04 02	**EUROCONTROL**						
LO	Describe the objectives of the Convention relating to the Cooperation for the Safety of Air Navigation (Eurocontrol) and the Single European Sky (SES) Regulations.	x	x	x	x	x	
010 01 04 03	**European Civil Aviation Conference (ECAC)**						
LO	Give a brief summary of the European Civil Aviation Conference (ECAC).	x	x	x	x	x	
010 02 00 00	**AIRWORTHINESS OF AIRCRAFT**						
010 02 01 00	**ICAO Annex 8 and the related Certification Specifications**						
LO	Explain the definitions of ICAO Annex 8.	x	x	x	x	x	
LO	Explain how the Airworthiness Standards of ICAO Annex 8 and the Certification Specifications (CSs) are related to each other.	x	x	x	x	x	
LO	State which aircraft the Standards of ICAO Annex 8 and the CSs shall apply to.	x	x	x	x	x	
010 02 02 00	**Certificate of Airworthiness (CofA)**						
LO	State the issuing authority of a CofA.	x	x	x	x	x	
LO	State the necessity to have a CofA.	x	x	x	x	x	
LO	Explain the various elements that are required for a CofA.	x	x	x	x	x	
LO	State who shall determine an aircraft's continuing airworthiness.	x	x	x	x	x	
LO	Describe how a Certificate of Airworthiness can be renewed or may remain valid.	x	x	x	x	x	
010 03 00 00	**AIRCRAFT NATIONALITY AND REGISTRATION MARKS**						
010 03 01 00	**Definitions of ICAO Annex 7**						
LO	Recall the definitions of the following terms: aircraft; heavier-than-air aircraft; State of Registry.	x	x	x	x	x	

010 03 02 00	**Aircraft nationality, common and registration marks to be used**						
LO	State the location of nationality and common and registration marks.	x		x			
LO	Explain the combination of nationality and registration marks (sequence, use of hyphen).	x	x	x	x	x	
LO	State who is responsible for assigning registration marks.	x	x	x	x	x	
010 04 00 00	**PERSONNEL LICENSING**						
010 04 01 00	**ICAO Annex 1**						
010 04 01 01	**Differences between ICAO Annex 1 and the Aircrew Regulation**						
LO	Describe the relationship and differences between ICAO Annex 1 and the Aircrew Regulation.	x	x	x	x	x	x
010 04 02 00	**Part-FCL**						
010 04 02 01	**Definitions**						
LO	Define the following: category of aircraft, cross-country, dual instruction time, flight time, SPIC, instrument time, instrument flight time, instrument ground time, MCC, multi-pilot aircraft, night, private pilot, proficiency check, renewal, revalidation, skill test, solo flight time, type of aircraft.	x	x	x	x	x	x
010 04 02 02	**Content and structure**						
LO	Explain the structure of Part FCL.	x	x	x	x	x	x
LO	Understand the difference between Part-FCL and AMC/GM to Part-FCL.	x	x	x	x	x	x
LO	Explain the requirements to act as a flight crew member of a civil aircraft registered in a Member State.	x	x	x	x	x	x
LO	State to what extent Member States will accept certificates issued by other Member States.	x	x	x	x	x	x
LO	List the two factors that are relevant to the exercise of the privileges of a licence.	x	x	x	x	x	x
LO	State the circumstances in which a language-proficiency endorsement is required.	x	x	x	x	x	x

LO	List the restrictions for licence holders with an age of 60 years or more.	x	x	x	x	x	
LO	Explain the term 'competent authority'.	x	x	x	x	x	x
LO	Describe the obligation to carry and present documents (e.g. a flight crew licence) under Part-FCL.	x	x	x	x	x	x
010 04 02 03	**Commercial Pilot Licence (CPL)**						
LO	State the requirements for the issue of a CPL.	x	x	x	x	x	
LO	State the privileges of a CPL.	x	x	x	x	x	
010 04 02 04	**Airline Transport Pilot Licence (ATPL) and Multi-crew Pilot Licence (MPL)**						
LO	State the requirements for the issue of an ATPL and MPL.	x		x	x		
LO	State the privileges of an ATPL and MPL.	x		x	x		
010 04 02 05	**Ratings**						
LO	Explain the requirements for class ratings, their validity and privileges.	x	x				
LO	Explain the requirements for type ratings, their validity and privileges.	x	x	x	x	x	
LO	Explain the requirements for instrument ratings, their validity and privileges.	x		x			x
010 04 03 00	**Part-MED**						
LO	Describe the relevant content of Part-MED — Medical Requirements (administrative parts and requirements related to licensing only).	x	x	x	x	x	x
LO	State the requirements for a medical certificate.	x	x	x	x	x	x
LO	Name the kind of medical certificate required when exercising the privileges of a CPL or ATPL.	x	x	x	x	x	
LO	State the actions to be taken in case of a decrease in medical fitness.	x	x	x	x	x	x
010 05 00 00	**RULES OF THE AIR**						
010 05 01 00	**Definitions of ICAO Annex 2**						
LO	Explain the definitions of ICAO Annex 2.	x	x	x	x	x	x
010 05 02 00	**Applicability of the Rules of the Air**						

LO	Explain the territorial application of the ICAO Rules of the Air.	x	x	x	x	x	
LO	Explain the compliance with the Rules of the Air.	x	x	x	x	x	
LO	State who on board an aircraft is primarily responsible for the operation of the aircraft in accordance with the Rules of the Air.	x	x	x	x	x	
LO	Indicate under what circumstances departure from the Rules of the Air may be allowed.	x	x	x	x	x	
LO	Explain the duties of the PIC concerning pre-flight actions in case of an IFR flight.	x		x			x
LO	State who has the final authority as to the disposition of the aircraft.	x	x	x	x	x	
LO	Explain the problematic in the use of psychoactive substances by flight crew members.	x	x	x	x	x	x
010 05 03 00	**General rules**						
LO	Describe the rules for the avoidance of collisions.	x	x	x	x	x	
LO	Describe the lights to be displayed by aircraft.	x	x	x	x	x	
LO	Understand marshalling signals.	x	x	x	x	x	
LO	State the basic requirements for minimum height for the flight over congested areas of cities, towns or settlements, or over an open-air assembly of persons.	x	x	x	x	x	
LO	Define when the cruising levels shall be expressed in terms of flight levels (FL).	x	x	x	x	x	
LO	Define under what circumstances cruising levels shall be expressed in terms of altitudes.	x	x	x	x	x	
LO	Explain the limitation for proximity to other aircraft and the right-of-way rules, including holding at runway-holding positions and lighted stop bars.	x	x	x	x	x	
LO	Describe the meaning of light signals displayed to and by the aircraft.	x	x	x	x	x	
LO	Describe the requirements when carrying out simulated instrument flights.	x		x			x
LO	Indicate the basic rules for an aircraft operating on and in the vicinity of an aerodrome (AD).	x	x	x	x	x	

LO	Explain the requirements for the submission of an ATS flight plan.	x	x	x	x	x	
LO	Explain why a time check has to be obtained before the flight.	x	x	x	x	x	x
LO	Explain the actions to be taken in case of flight-plan change or delay.	x	x	x	x	x	x
LO	State the actions to be taken in case of inadvertent changes to track, true airspeed (TAS) and time estimate affecting the current flight plan.	x	x	x	x	x	x
LO	Explain the procedures for closing a flight plan.	x	x	x	x	x	
LO	State for which flights an air traffic control clearance shall be obtained.	x	x	x	x	x	
LO	State how a pilot may request an air traffic control clearance.	x	x	x	x	x	
LO	State the action to be taken if an air traffic control clearance is not satisfactory to a pilot-in-command.	x	x	x	x	x	
LO	Describe the required actions to be carried out if the continuation of a controlled VFR flight in VMC is not practicable anymore.	x		x			x
LO	Describe the provisions for transmitting a position report to the appropriate ATS unit including time of transmission and normal content of the message.	x	x	x	x	x	x
LO	Describe the necessary action when an aircraft experiences a COM failure.	x	x	x	x	x	x
LO	State what information an aircraft being subjected to unlawful interference shall give to the appropriate ATS unit.	x	x	x	x	x	x
010 05 04 00	**Visual Flight Rules (VFRs)**						
LO	Describe the Visual Flight Rules as contained in Chapter 4 of ICAO Annex 2.	x	x	x	x	x	
010 05 05 00	**Instrument Flight Rules (IFRs)**						
LO	Describe the Instrument Flight Rules as contained in Chapter 5 of ICAO Annex 2.	x		x			x
010 05 06 00	**Interception of civil aircraft**						
LO	List the possible reasons for intercepting a civil aircraft.	x	x	x	x	x	

LO	State what primary action should be carried out by an intercepted aircraft.	x	x	x	x	x	
LO	State which frequency should primarily be tried in order to contact an intercepting aircraft.	x	x	x	x	x	
LO	State on which mode and code a transponder on board the intercepted aircraft should be operated.	x	x	x	x	x	
LO	Recall the interception signals and phrases.	x	x	x	x	x	
010 06 00 00	**PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS-OPS)**						
010 06 01 00	**Foreword and introduction**						
LO	Translate the term 'PANS-OPS' into plain language.	x		x			x
LO	State the general aim of PANS-OPS Flight Procedures (ICAO Doc 8168, Volume I).	x		x			x
010 06 02 00	**Definitions and abbreviations**						
LO	Recall all definitions included in ICAO Doc 8168, Volume I, Part I, Chapter 1.	x		x			x
LO	Interpret all abbreviations as shown in ICAO Doc 8168, Volume I, Part I, Chapter 2.	x		x			x
010 06 03 00	**Departure procedures**						
010 06 03 01	**General criteria (assuming all engines operating)**						
LO	Name the factors dictating the design of instrument-departure procedures.	x		x			x
LO	Explain in which situations the criteria for omnidirectional departures are applied.	x		x			x
010 06 03 02	**Standard instrument departures (SIDs)**						
LO	Define the terms 'straight departure' and 'turning departure'.	x		x			x
LO	State the responsibility of the operator when unable to utilise the published departure procedures.	x		x			x
010 06 03 03	**Omnidirectional departures**						
LO	Explain when the 'omnidirectional method' is used for departure.	x		x			x

LO	Describe the solutions when an omnidirectional procedure is not possible.	x		x			x
010 06 03 04	**Published information**						
LO	State the conditions for the publication of a SID and/or RNAV route.	x		x			x
LO	Describe how omnidirectional departures are expressed in the appropriate publication.	x		x			x
010 06 03 05	Area Navigation (RNAV) departure procedures and RNP-based departures						
LO	Explain the relationship between RNAV/RNP-based departure procedures and those for approaches.	x		x			x
010 06 04 00	**Approach procedures**						
010 06 04 01	**General criteria**						
LO	General criteria (except the table 'Speeds for procedure calculations') of the approach procedure design: instrument approach areas; accuracy of fixes; fixes formed by intersections; intersection fix-tolerance factors; other fix-tolerance factors; approach area splays; descent gradient.	x		x			x
LO	Name the five possible segments of an instrument approach procedure.	x		x			x
LO	Give reasons for establishing aircraft categories for the approach.	x		x			x
LO	State the maximum angle between the final approach track and the extended RWY centre line to still consider a non-precision-approach as being a 'straight-in approach'.	x		x			x
LO	State the minimum obstacle clearance provided by the minimum sector altitudes (MSAs) established for an aerodrome.	x		x			x
LO	Describe the point of origin, shape, size and subdivisions of the area used for MSAs.	x		x			x

LO	State that a pilot shall apply wind corrections when carrying out an instrument-approach procedure.	x		x			x
LO	Name the most significant performance factor influencing the conduct of instrument-approach procedures.	x		x			x
LO	Explain why a pilot should not descend below OCA/Hs which are established for: precision-approach procedures; non-precision-approach procedures; visual (circling) procedures.	x		x			x
LO	Describe in general terms the relevant factors for the calculation of operational minima.	x		x			x
LO	Translate the following acronyms into plain language: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H.	x		x			x
LO	Explain the relationship between the terms: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H.	x		x			x
010 06 04 02	**Approach-procedure design**						
LO	Describe how the vertical cross section for each of the five approach segments is broken down into the various areas.	x		x			x
LO	State within which area of the cross section the Minimum Obstacle Clearance (MOC) is provided for the whole width of the area.	x		x			x
LO	Define the terms 'IAF', 'IF', 'FAF', 'MAPt' and 'TP'.	x		x			x
LO	Name the area within which the plotted point of an intersection fix may lie.	x		x			x
LO	Explain by which factors the dimensions of an intersection fix are determined.	x		x			x
LO	State the accuracy of facilities providing track (VOR, ILS, NDB).	x		x			x
LO	Describe the 'other fix-tolerance factors': surveillance radar (Terminal Area Radar (TAR)), En Route Surveillance Radar (RSR), DME, 75 MHz marker beacon, fixes overhead a station (VOR, NDB).	x		x			x

LO	Describe the basic information relating to approach-area splays.	x		x			x
LO	State the optimum descent gradient (preferred for a precision approach) in degrees and per cent.	x		x			x
010 06 04 03	**Arrival and approach segments**						
LO	Name the five standard segments of an instrument APP procedure and state the beginning and end for each of them.	x		x			x
LO	Describe where an ARR route normally ends.	x		x			x
LO	State whether or not omnidirectional or sector arrivals can be provided.	x		x			x
LO	Explain the main task of the initial APP segment.	x		x			x
LO	Describe the maximum angle of interception between the initial APP segment and the intermediate APP segment (provided at the intermediate fix) for a precision approach and a non-precision approach.	x		x			x
LO	Describe the main task of the intermediate APP segment.	x		x			x
LO	State the main task of the final APP segment.	x		x			x
LO	Name the two possible aims of a final APP.	x		x			x
LO	Explain the term ‘final approach point’ in case of an ILS approach.	x		x			x
LO	State what happens if an ILS GP becomes inoperative during the APP.	x		x			x
010 06 04 04	**Missed approach**						
LO	Name the three phases of a missed-approach procedure and describe their geometric limits.	x		x			x
LO	Describe the main task of a missed-approach procedure.	x		x			x
LO	State at which height/altitude the missed approach is assured to be initiated.	x		x			x
LO	Define the term ‘missed approach point (MAPt)’.	x		x			x
LO	Describe how an MAPt may be established in an approach procedure.	x		x			x

LO	State the pilot's reaction if, upon reaching the MAPt, the required visual reference is not established.	x		x			x
LO	Describe what a pilot is expected to do in the event a missed approach is initiated prior to arriving at the MAPt.	x		x			x
LO	State whether the pilot is obliged to cross the MAPt at the height/altitude required by the procedure or whether they are allowed to cross the MAPt at an altitude/height greater than that required by the procedure.	x		x			x
010 06 04 05	**Visual manoeuvring (circling) in the vicinity of the aerodrome**						
LO	Describe what is meant by 'visual manoeuvring (circling)'.	x		x			x
LO	Describe how a prominent obstacle in the visual manoeuvring (circling) area outside the final-approach and missed-approach area has to be considered for the visual circling.	x		x			x
LO	State for which category of aircraft the obstacle-clearance altitude/ height within an established visual-manoeuvring (circling) area is determined.	x		x			x
LO	Describe how an MDA/H is specified for visual manoeuvring (circling) if the OCA/H is known.	x		x			x
LO	State the conditions to be fulfilled before descending below MDA/H in a visual-manoeuvring (circling) approach.	x		x			x
LO	Describe why there can be no single procedure designed that will cater for conducting a circling approach in every situation.	x		x			x
LO	State how the pilot is expected to behave after initial visual contact during a visual manoeuvring (circling).	x		x			x
LO	Describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach.	x		x			x
010 06 04 06	**Area Navigation (RNAV) approach procedures based on VOR/DME**						
LO	Describe the provisions that must be fulfilled before carrying out VOR/DME RNAV approaches.	x		x			x

LO	Explain the disadvantages of the VOR/DME RNAV system.	x		x			x
LO	List the factors the navigational accuracy of the VOR/DME RNAV system depends on.	x		x			x
LO	State whether the VOR/DME/RNAV approach is a precision or a non-precision procedure.	x		x			x
010 06 04 07	**Use of FMS/RNAV equipment to follow conventional non-precision approach procedures**						
LO	State the provisions for flying the conventional non-precision approach procedures using FMS/RNAV equipment.	x		x			x
010 06 05 00	**Holding procedures**						
010 06 05 01	**Entry and holding**						
LO	Explain why deviations from the in-flight procedures of a holding established in accordance with Doc 8168 are dangerous.	x		x			x
LO	State that if for any reasons a pilot is unable to conform to the procedures for normal conditions laid down for any particular holding pattern, they should advise ATC as early as possible.	x		x			x
LO	Describe how right-turn holdings can be transferred to left-turn holding patterns.	x		x			x
LO	Describe the shape and terminology associated with the holding pattern.	x		x			x
LO	State the bank angle and rate of turn to be used whilst flying in a holding pattern.	x		x			x
LO	Explain why pilots in a holding pattern should attempt to maintain tracks and how this can be achieved.	x		x			x
LO	Describe where outbound timing begins in a holding pattern.	x		x			x
LO	State where the outbound leg in a holding terminates if the outbound leg is based on DME.	x		x			x
LO	Describe the three heading-entry sectors for entries into a holding pattern.	x		x			x
LO	Define the terms ‘parallel entry’, ‘offset entry’ and ‘direct entry’.	x		x			x

LO	Determine the correct entry procedure for a given holding pattern.	x		x			x
LO	State the still air time for flying the outbound entry heading with or without DME.	x		x			x
LO	Describe what the pilot is expected to do when clearance is received specifying the time of departure from the holding point.	x		x			x
010 06 05 02	**Obstacle clearance (except table)**						
LO	Describe the layout of the basic holding area, entry area and buffer area of a holding pattern.	x		x			x
LO	State which obstacle clearance is provided by a minimum permissible holding level referring to the holding area, the buffer area (general only) and over high terrain or in mountainous areas.	x		x			x
010 06 06 00	**Altimeter-setting procedures**						
010 06 06 01	**Basic requirements and procedures**						
LO	Describe the two main objectives of altimeter settings.	x	x	x	x	x	x
LO	Define the terms 'QNH' and 'QFE'.	x	x	x	x	x	x
LO	Describe the different terms for altitude or flight levels respectively which are the references during climb or descent to change the altimeter setting from QNH to 1013.2 hPa and vice versa.	x	x	x	x	x	x
LO	Define the term 'Flight Level (FL)'.	x	x	x	x	x	x
LO	State where flight level zero shall be located.	x	x	x	x	x	x
LO	State the interval by which consecutive flight levels shall be separated.	x	x	x	x	x	x
LO	Describe how flight levels are numbered.	x	x	x	x	x	x
LO	Define the term 'Transition Altitude'.	x	x	x	x	x	x
LO	State how Transition Altitudes shall normally be specified.	x	x	x	x	x	x
LO	Explain how the height of the Transition Altitude is calculated and expressed in practice.	x	x	x	x	x	x
LO	State where Transition Altitudes shall be published.	x	x	x	x	x	x
LO	Define the term 'Transition Level'.	x	x	x	x	x	x

LO	State when the Transition Level is normally passed on to the aircraft.	x	x	x	x	x	x
LO	State how the vertical position of the aircraft shall be expressed at or below the Transition Altitude and Transition Level.	x	x	x	x	x	x
LO	Define the term 'Transition Layer'.	x	x	x	x	x	x
LO	Describe when the vertical position of an aircraft passing through the transition layer shall be expressed in terms of flight levels and when in terms of altitude.	x	x	x	x	x	x
LO	State when the QNH altimeter setting shall be made available to departing aircraft.	x	x	x	x	x	x
LO	Explain when the vertical separation of an aircraft during en route flight shall be assessed in terms of altitude and when in terms of flight levels.	x	x	x	x	x	x
LO	Explain when, in air–ground communications during an en route flight, the vertical position of an aircraft shall be expressed in terms of altitude and when in terms of flight levels.	x	x	x	x	x	x
LO	Describe why QNH altimeter-setting reports should be provided from sufficient locations.	x	x	x	x	x	x
LO	State how a QNH altimeter setting shall be made available to aircraft approaching a controlled aerodrome for landing.	x	x	x	x	x	x
LO	State under which circumstances the vertical position of an aircraft above the transition level may be referenced to altitudes.	x	x	x	x	x	x
010 06 06 02	**Procedures for operators and pilots**						
LO	State the three requirements that selected altitudes or selected flight levels should have.	x	x	x	x	x	x
LO	Describe a pre-flight operational test in case of QNH setting and in case of QFE setting including indication (error) tolerances referred to the different test ranges.	x	x	x	x	x	x
LO	State on which setting at least one altimeter shall be set prior to take-off.	x	x	x	x	x	x
LO	State where during the climb the altimeter setting shall be changed from QNH to 1013.2 hPa.	x	x	x	x	x	x

LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the transition level.	x	x	x	x	x	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the actual QNH altimeter setting.	x	x	x	x	x	x
LO	State where the altimeter settings shall be changed from 1013.2 hPa to QNH during descent for landing.	x	x	x	x	x	x
010 06 07 00	**Simultaneous operation on parallel or near-parallel instrument runways**						
LO	Describe the difference between independent and dependent parallel approaches.	x	x	x	x	x	x
LO	Describe the following different operations: simultaneous instrument departures; segregated parallel approaches/departures; semi-mixed and mixed operations.	x	x	x	x	x	x
LO	Know about 'NOZ' and 'NTZ'.	x	x	x	x	x	x
LO	Name the aircraft equipment requirements for conducting parallel instrument approaches.	x	x	x	x	x	x
LO	State under which circumstances parallel instrument approaches may be conducted.	x	x	x	x	x	x
LO	State the radar requirements for simultaneous, independent, parallel instrument approaches and how weather conditions effect these.	x	x	x	x	x	x
LO	State the maximum angle of interception for an ILS localiser CRS or MLS final APP track in case of simultaneous, independent, parallel instrument approaches.	x	x	x	x	x	x
LO	Describe the special conditions for tracks on missed approach procedures and departures in case of simultaneous, parallel operations.	x	x	x	x	x	x
010 06 08 00	**Secondary surveillance radar (transponder) operating procedures**						
010 06 08 01	**Operation of transponders**						
LO	State when and where the pilot shall operate the transponder.	x	x	x	x	x	x

LO	State the modes and codes that the pilot shall operate in the absence of any ATC directions or regional air navigation agreements.	x	x	x	x	x	x
LO	Indicate when the pilot shall operate Mode C.	x	x	x	x	x	x
LO	State when the pilot shall 'SQUAWK IDENT'.	x	x	x	x	x	x
LO	State the transponder mode and code to indicate: a state of emergency; a communication failure; unlawful interference.	x	x	x	x	x	x
LO	Describe the consequences of a transponder failure in flight.	x	x	x	x	x	x
LO	State the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at the given aerodrome is possible.	x	x	x	x	x	x
010 06 08 02	**Operation of ACAS equipment**						
LO	Describe the main reason for using ACAS.	x	x	x	x	x	x
LO	Indicate whether the 'use of ACAS indications' described in Doc 8168 is absolutely mandatory.	x	x	x	x	x	x
LO	Explain the pilots' reaction required to allow ACAS to fulfil its role of assisting pilots in the avoidance of potential collisions.	x	x	x	x	x	x
LO	Explain why pilots shall not manoeuvre their aircraft in response to Traffic Advisories only.	x	x	x	x	x	x
LO	Explain the significance of Traffic Advisories in view of possible Resolution Advisories.	x	x	x	x	x	x
LO	State why a pilot should follow Resolution Advisories immediately.	x	x	x	x	x	x
LO	List the reasons which may force a pilot to disregard a Resolution Advisory.	x	x	x	x	x	x
LO	Decide how a pilot shall react if there is a conflict between Resolution Advisories in case of an ACAS/ACAS coordinated encounter Resolution Advisories.	x	x	x	x	x	x
LO	Explain the importance of instructing ATC immediately that a Resolution Advisory has been followed.	x	x	x	x	x	x

LO	Explain the duties of a pilot as far as ATC is concerned when a Resolution Advisory situation is resolved.	x	x	x	x	x	x
010 07 00 00	**AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT**						
010 07 01 00	**ICAO Annex 11 — Air Traffic Services**						
010 07 01 01	**Definitions**						
LO	Recall the definitions given in ICAO Annex 11.	x	x	x	x	x	x
010 07 01 02	**General**						
LO	Name the objectives of Air Traffic Services (ATS).	x	x	x	x	x	x
LO	Describe the three basic types of Air Traffic Services.	x	x	x	x	x	x
LO	Describe the three basic types of Air Traffic Control services (ATC).	x	x	x	x	x	x
LO	Indicate when aerodrome control towers shall provide an accurate time check to pilots.	x	x	x	x	x	x
LO	State on which frequencies a pilot can expect ATS to contact them in case of an emergency.	x	x	x	x	x	x
LO	Understand the procedure for the transfer of an aircraft from one ATC unit to another.	x	x	x	x	x	
010 07 01 03	**Airspace**						
LO	Describe the purpose for establishing FIRs including UIRs.	x	x	x	x	x	x
LO	Understand the various rules and services that apply to the various classes of airspace.	x	x	x	x	x	x
LO	Explain which airspace shall be included in an FIR or UIR.	x	x	x	x	x	x
LO	State the designation for those portions of the airspace where flight information service (FIS) and alerting service shall be provided.	x	x	x	x	x	x
LO	State the designations for those portions of the airspace where ATC service shall be provided.	x	x	x	x	x	x
LO	Indicate whether or not CTAs and CTRs designated within an FIR shall form part of that FIR.	x	x	x	x	x	x
LO	Name the lower limit of a CTA as far as ICAO standards are concerned.	x	x	x	x	x	x

LO	State whether or not the lower limit of a CTA has to be established uniformly.	x	x	x	x	x	x
LO	Explain why a UIR or Upper CTA should be delineated to include the Upper Airspace within the lateral limits of a number of lower FIRs or CTAs.	x	x	x	x	x	x
LO	Describe in general the lateral limits of CTRs.	x	x	x	x	x	x
LO	State the minimum extension (in NM) of the lateral limits of a CTR.	x	x	x	x	x	x
LO	State the upper limits of a CTR located within the lateral limits of a CTA.	x	x	x	x	x	x
010 07 01 04	**Air Traffic Control services**						
LO	Name all classes of airspace in which ATC shall be provided.	x	x	x	x	x	x
LO	Name the ATS units providing ATC service (area control service, approach control service, aerodrome control service).	x	x	x	x	x	x
LO	Describe which unit(s) may be assigned with the task to provide specified services on the apron.	x	x	x	x	x	x
LO	Name the purpose of clearances issued by an ATC unit.	x	x	x	x	x	x
LO	Describe the aim of clearances issued by ATC with regard to IFR, VFR or special VFR flights, and refer to the different airspaces.	x	x	x	x	x	x
LO	List the various (five possible) parts of an ATC clearance.	x	x	x	x	x	x
LO	Describe the various aspects of clearance coordination.	x	x	x	x	x	x
LO	State how ATC shall react when it becomes apparent that traffic, additional to that already accepted, cannot be accommodated within a given period of time at a particular location or in a particular area, or can only be accommodated at a given rate.	x	x	x	x	x	x
LO	Explain why the movement of persons, vehicles and towed aircraft on the manoeuvring area of an AD shall be controlled by the AD TWR (as necessary).	x	x	x	x	x	x
010 07 01 05	**Flight Information Service (FIS)**						
LO	State for which aircraft FIS shall be provided.	x	x	x	x	x	x

LO	State whether or not FIS shall include the provision of pertinent SIGMET and AIRMET information.	x	x	x	x	x	x
LO	State which information FIS shall include in addition to SIGMET and AIRMET information.	x	x	x	x	x	x
LO	Indicate which other information the FIS shall include in addition to the special information given in ANNEX 11.	x	x	x	x	x	x
LO	Name the three major types of operational FIS broadcasts.	x	x	x	x	x	x
LO	Give the meaning of the acronym ATIS in plain language.	x	x	x	x	x	x
LO	Show that you are acquainted with the basic conditions for transmitting an ATIS as indicated in ANNEX 11.	x	x	x	x	x	x
LO	Mention the four possible ATIS messages.	x	x	x	x	x	x
LO	List the basic information concerning ATIS broadcasts (e.g. frequencies used, number of ADs included, updating, identification, acknowledgment of receipt, language and channels, ALT setting).	x	x	x	x	x	x
LO	Understand the content of an ATIS message and the factors involved.	x	x	x	x	x	
LO	State the reasons and circumstances when an ATIS message shall be updated.	x	x	x	x	x	x
010 07 01 06	**Alerting service**						
LO	Indicate who provides the alerting service.	x	x	x	x	x	
LO	State who is responsible for initiating the appropriate emergency phase.	x	x	x	x	x	
LO	Indicate the aircraft to which alerting service shall be provided.	x	x	x	x	x	
LO	Name the unit which shall be notified by the responsible ATS unit immediately when an aircraft is considered to be in a state of emergency.	x	x	x	x	x	
LO	Name the three stages of emergency and describe the basic conditions for each kind of emergency.	x	x	x	x	x	
LO	Demonstrate knowledge of the meaning of the expressions INCERFA, ALERFA and DETRESFA.	x	x	x	x	x	

LO	Describe the limiting conditions for the information of aircraft in the vicinity of an aircraft being in a state of emergency.	x	x	x	x	x	
010 07 01 07	**Principles governing RNP and ATS route designators**						
LO	State the meaning of the expressions RNP 4, RNP 1, etc.	x	x	x	x	x	
LO	State the factors that RNP is based on.	x	x	x	x	x	
LO	Describe the reason for establishing a system of route designators and Required Navigation Performance (RNP).	x	x	x	x	x	
LO	State whether or not a prescribed RNP type is considered an integral part of the ATS route designator.	x	x	x	x	x	
LO	Demonstrate general knowledge of the composition of an ATS route designator.	x	x	x	x	x	
010 07 02 00	**ICAO Document 4444 — Air Traffic Management**						
010 07 02 01	**Foreword (Scope and purpose)**						
LO	Explain in plain language the meaning of the acronym 'PANS-ATM'.	x	x	x	x	x	x
LO	State whether or not the procedures prescribed in ICAO Doc 4444 are directed exclusively to ATS services personnel.	x	x	x	x	x	x
LO	Describe the relationship between ICAO Doc 4444 and other documents.	x	x	x	x	x	x
LO	State whether or not a clearance issued by ATC units does include prevention of collision with terrain, and if there is an exception to this, name the exception.	x	x	x	x	x	x
010 07 02 02	**Definitions**						
LO	Recall all definitions given in Doc 4444 except the following: accepting unit/controller, AD taxi circuit, aeronautical fixed service (AFS), aeronautical fixed station, air-taxiing, allocation, approach funnel, assignment, data convention, data processing, discrete code, D-value, flight status, ground effect, receiving unit/controller, sending unit/controller, transfer of control point, transferring unit/controller, unmanned free balloon.	x	x	x	x	x	x

010 07 02 03	**ATS system capacity and Air Traffic Flow Management (ATFM)**						
LO	Explain when and where ATFM service shall be implemented.	x	x	x	x	x	x
010 07 02 04	**General provisions for Air Traffic Services**						
LO	Describe who is responsible for the provision of flight information and alerting service within a Flight Information Region (FIR) within controlled airspace and at controlled aerodromes.	x	x	x	x	x	x
010 07 02 05	**ATC clearances**						
LO	Explain 'the sole scope and purpose' of an ATC clearance.	x	x	x	x	x	x
LO	State which information the issue of an ATC clearance is based on.	x	x	x	x	x	x
LO	Describe what a PIC should do if an ATC clearance is not suitable.	x	x	x	x	x	x
LO	Indicate who bears the responsibility for adhering to the applicable rules and regulations whilst flying under the control of an ATC unit.	x	x	x	x	x	x
LO	Name the two primary purposes of clearances issued by ATC units.	x	x	x	x	x	x
LO	State why clearances must be issued 'early enough' to en route aircraft.	x	x	x	x	x	x
LO	Explain what is meant by the expression 'clearance limit'.	x	x	x	x	x	x
LO	Explain the meaning of the phrases 'cleared via flight planned route', 'cleared via (designation) departure' and 'cleared via (designation) arrival' in an ATC clearance.	x	x	x	x	x	x
LO	List which items of an ATC clearance shall always be read back by the flight crew.	x	x	x	x	x	x
010 07 02 06	**Horizontal speed control instructions**						
LO	Explain the reason for speed control by ATC.	x	x	x	x	x	x
LO	Define the maximum speed changes that ATC may impose.	x	x	x	x	x	x
LO	State within which distance from the threshold the PIC must not expect any kind of speed control.	x	x	x	x	x	x

010 07 02 07	**Change from IFR to VFR flight**						
LO	Explain how the change from IFR to VFR can be initiated by the PIC.	x		x			x
LO	Indicate the expected reaction of the appropriate ATC unit upon a request to change from IFR to VFR.	x		x			x
010 07 02 08	**Wake turbulence**						
LO	State the wake-turbulence categories of aircraft.	x	x	x	x	x	x
LO	State the wake-turbulence separation minima.	x	x	x	x	x	x
LO	Describe how a 'heavy' aircraft shall indicate this in the initial radio-telephony contact with ATS.	x	x	x	x	x	x
010 07 02 09	**Altimeter-setting procedures**						
LO	Define the following terms: transition level; transition layer; and transition altitude.	x	x	x	x	x	x
LO	Indicate how the vertical position of an aircraft in the vicinity of an aerodrome shall be expressed at or below the transition altitude, at or above the transition level, and while climbing or descending through the transition layer.	x	x	x	x	x	x
LO	Describe when the height of an aircraft using QFE during an NDB approach is referred to the landing threshold instead of the aerodrome elevation.	x	x	x	x	x	x
LO	Indicate how far altimeter settings provided to aircraft shall be rounded up or down.	x	x	x	x	x	x
LO	Define the expression 'lowest usable flight level'.	x	x	x	x	x	x
LO	Determine how the vertical position of an aircraft on an en route flight is expressed at or above the lowest usable flight level and below the lowest usable flight level.	x	x	x	x	x	x
LO	State who establishes the transition level to be used in the vicinity of an aerodrome.	x	x	x	x	x	x
LO	Decide how and when a flight crew member shall be informed about the transition level.	x	x	x	x	x	x

LO	State whether or not the pilot can request the transition level to be included in the approach clearance.	x	x	x	x	x	x
LO	State in what kind of clearance the QNH altimeter setting shall be included.	x	x	x	x	x	x
010 07 02 10	**Position reporting**						
LO	Describe when position reports shall be made by an aircraft flying on routes defined by designated significant points.	x	x	x	x	x	x
LO	List the six items that are normally included in a voice position report.	x	x	x	x	x	x
LO	Name the requirements for using a simplified position report with flight level, next position (and time over) and ensuing significant points omitted.	x	x	x	x	x	x
LO	Name the item of a position report which must be forwarded to ATC with the initial call after changing to a new frequency.	x	x	x	x	x	x
LO	Indicate the item of a position report which may be omitted if SSR Mode C is used.	x	x	x	x	x	x
LO	Explain in which circumstances the indicated airspeed should be included in a position report.	x	x	x	x	x	x
LO	Explain the meaning of the acronym ‘ADS’.	x	x	x	x	x	x
LO	State to which unit an ADS report shall be made.	x	x	x	x	x	x
LO	Describe how ADS reports shall be made.	x	x	x	x	x	x
LO	Describe which expression shall precede the level figures in a position report if the level is reported in relation to 1013.2 hPa (standard pressure).	x	x	x	x	x	x
010 07 02 11	**Reporting of operational and meteorological information**						
LO	List the occasions when special air reports shall be made.	x	x	x	x	x	x
010 07 02 12	**Separation methods and minima**						
LO	Explain the general provisions for the separation of controlled traffic.	x		x			x
LO	Name the different kinds of separation used in aviation.	x		x			x

LO	Understand the difference between the type of separation provided within the various classes of airspace and the various types of flight.	x		x			x
LO	State who is responsible for the avoidance of collision with other aircraft when operating in VMC.	x		x			x
LO	State the ICAO documents in which details of current separation minima are prescribed.	x		x			x
LO	Describe how vertical separation is obtained.	x		x			x
LO	State the required vertical separation minimum.	x		x			x
LO	Describe how the cruising levels of aircraft flying to the same destination and in the expected approach sequence are correlated with each other.	x		x			x
LO	Name the conditions that must be adhered to when two aircraft are cleared to maintain a specified vertical separation between them during climb or descent.	x		x			x
LO	List the two main methods for horizontal separation.	x		x			x
LO	Describe how lateral separation of aircraft at the same level may be obtained.	x		x			x
LO	Explain the term ‘geographical separation’.	x		x			x
LO	Describe track separation between aircraft using the same navigation aid or method.	x		x			x
LO	Describe the three basic means for the establishment of longitudinal separation.	x		x			x
LO	Describe the circumstances under which a reduction in separation minima may be allowed.	x		x			x
LO	Indicate the standard horizontal radar separation in NM.	x		x			x
LO	Describe the method of the Mach-number technique.	x					
LO	State the wake-turbulence radar separation for aircraft in the APP and DEP phases of a flight when an aircraft is operating directly behind another aircraft at the same ALT or less than 300 m (1 000 ft) below.	x		x			x

010 07 02 13	**Separation in the vicinity of aerodromes**						
LO	Define the expression 'Essential Local Traffic'.	x	x	x	x	x	x
LO	State which possible decision the PIC may choose to take if departing aircraft are expedited by suggesting a take-off direction which is not 'into the wind'.	x	x	x	x	x	x
LO	State the condition to enable ATC to initiate a visual approach for an IFR flight.	x	x	x	x	x	x
LO	Indicate whether or not separation shall be provided by ATC between an aircraft executing a visual approach and other arriving or departing aircraft.	x	x	x	x	x	x
LO	State in which case, when the flight crew are not familiar with the instrument approach procedure being carried out, only the final approach track has to be forwarded to them by ATC.	x	x	x	x	x	x
LO	Describe which flight level should be assigned to an aircraft first arriving over a holding fix for landing.	x	x	x	x	x	x
LO	Talk about the priority that shall be given to aircraft for a landing.	x	x	x	x	x	x
LO	Understand the situation when a pilot of an aircraft in an approach sequence indicates their intention to hold for weather improvements.	x	x	x	x	x	x
LO	Explain the term 'Expected Approach Time' and the procedures for its use.	x	x	x	x	x	x
LO	State the reasons which could probably lead to the decision to use another take-off or landing direction than the one into the wind.	x	x	x	x	x	x
LO	Name the possible consequences for a PIC if the 'RWY-in-use' is not considered suitable for the operation involved.	x	x	x	x	x	x
010 07 02 14	**Miscellaneous separation procedures**						
LO	Be familiar with the separation of aircraft holding in flight.	x	x	x	x	x	x
LO	Be familiar with the minimum separation between departing aircraft.	x	x	x	x	x	x
LO	Be familiar with the minimum separation between departing and arriving aircraft.	x	x	x	x	x	x

LO	Be familiar with the non-radar wake-turbulence longitudinal separation minima.	x	x	x	x	x	x
LO	Know about a clearance to 'maintain own separation' while in VMC.	x	x	x	x	x	x
LO	Give a brief description of 'essential traffic' and 'essential traffic information'.	x	x	x	x	x	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed.	x	x	x	x	x	x
010 07 02 15	**Arriving and departing aircraft**						
LO	List the elements of information which shall be transmitted to an aircraft as early as practicable if an approach for landing is intended.	x	x	x	x	x	x
LO	List the information to be transmitted to an aircraft at the commencement of final approach.	x	x	x	x	x	x
LO	List the information to be transmitted to an aircraft during final approach.	x	x	x	x	x	x
LO	Acquaint yourself with all the information regarding arriving and/or departing aircraft on parallel or near-parallel runways, including knowledge about NTZ and NOZ and the various combinations of parallel arrivals and/or departures.	x	x	x	x	x	x
LO	State the sequence of priority between aircraft landing (or in the final stage of an approach to land) and aircraft intending to depart.	x	x	x	x	x	x
LO	Explain the factors that influence the approach sequence.	x	x	x	x	x	x
LO	State the significant changes in the meteorological conditions in the take-off or climb-out area that shall be transmitted without delay to a departing aircraft.	x	x	x	x	x	x
LO	Describe what information shall be forwarded to a departing aircraft as far as visual or non-visual aids are concerned.	x	x	x	x	x	x
LO	State the significant changes that shall be transmitted as early as practicable to an arriving aircraft, particularly changes in the meteorological conditions.	x	x	x	x	x	x
010 07 02 16	**Procedures for aerodrome control service**						

LO	Describe the general tasks of the Aerodrome Control Tower (TWR) when issuing information and clearances to aircraft under its control.	x	x	x	x	x	x
LO	List for which aircraft and their given positions or flight situations the TWR shall prevent collisions.	x	x	x	x	x	x
LO	Name the operational failure or irregularity of AD equipment which shall be reported to the TWR immediately.	x	x	x	x	x	x
LO	State that, after a given period of time, the TWR shall report to the ACC or FIC if an aircraft does not land as expected.	x	x	x	x	x	x
LO	Describe the procedures to be observed by the TWR whenever VFR operations are suspended.	x	x	x	x	x	x
LO	Explain the term 'RWY-in-use' and its selection.	x	x	x	x	x	x
LO	List the information the TWR should give to an aircraft: prior to taxiing for take-off; prior to take-off; prior to entering the traffic circuit.	x	x	x	x	x	x
LO	Explain that a report of surface wind direction given to a pilot by the TWR is magnetic.	x	x	x	x	x	x
LO	Explain the exact meaning of the expression 'runway vacated'.	x	x	x	x	x	x
010 07 02 17	**Radar services**						
LO	State to what extent the use of radar in air traffic services may be limited.	x	x	x	x	x	x
LO	State what radar-derived information shall be available for display to the controller as a minimum.	x	x	x	x	x	x
LO	Name the two basic identification procedures used with radar.	x	x	x	x	x	x
LO	Define the term 'PSR'.	x	x	x	x	x	x
LO	Describe the circumstances under which an aircraft provided with radar service should be informed of its position.	x	x	x	x	x	x
LO	List the possible forms of position information passed on to the aircraft by radar services.	x	x	x	x	x	x

LO	Define the term 'radar vectoring'.	x	x	x	x	x	x
LO	State the aims of radar vectoring as shown in ICAO Doc 4444.	x	x	x	x	x	x
LO	State how radar vectoring shall be achieved.	x	x	x	x	x	x
LO	Describe the information which shall be given to an aircraft when radar vectoring is terminated and the pilot is instructed to resume own navigation.	x	x	x	x	x	x
LO	Explain the procedures for the conduct of Surveillance Radar Approaches (SRA).	x	x	x	x	x	x
LO	Describe what kind of action (concerning the transponder) the pilot is expected to perform in case of emergency if they have previously been directed by ATC to operate the transponder on a specific code.	x	x	x	x	x	x
010 07 02 18	**Air traffic advisory service**						
LO	Describe the objective and basic principles of the air traffic advisory service.	x	x	x	x	x	x
LO	State to which aircraft air traffic advisory service shall be provided.	x	x	x	x	x	x
LO	Explain why air traffic advisory service does not deliver 'clearances' but only 'advisory information'.	x	x	x	x	x	x
010 07 02 19	**Procedures related to emergencies, communication failure and contingencies**						
LO	State the mode and code of SSR equipment a pilot might operate in a (general) state of emergency or (specifically) in case the aircraft is subject to unlawful interference.	x	x	x	x	x	x
LO	State the special rights an aircraft in a state of emergency can expect from ATC.	x	x	x	x	x	x
LO	Describe the expected action of aircraft after receiving a broadcast from ATS concerning the emergency descent of an aircraft.	x	x	x	x	x	x
LO	State how it can be ascertained, in case of a failure of two-way communication, whether the aircraft is able to receive transmissions from the ATS unit.	x	x	x	x	x	x
LO	Explain the assumption based on which separation shall be maintained if an aircraft is known to experience a COM failure in VMC or in IMC.	x	x	x	x	x	x

LO	State on which frequencies appropriate information, for an aircraft encountering two-way COM failure, shall be sent by ATS.	x	x	x	x	x	x
LO	Describe the expected actions of an ATS unit after having been informed that an aircraft is being intercepted in or outside its area of responsibility.	x	x	x	x	x	x
LO	State what is meant by the expression 'strayed aircraft' and 'unidentified aircraft'.	x	x	x	x	x	x
LO	Explain the minimum level for fuel-dumping and the reasons for this.	x	x	x	x	x	x
LO	Explain the possible request of ATC to an aircraft to change its RTF call sign.	x	x	x	x	x	x
010 07 02 20	**Miscellaneous procedures**						
LO	Explain the meaning of 'AIRPROX'.	x	x	x	x	x	x
LO	Determine the task of an air traffic incident report.	x	x	x	x	x	x
010 08 00 00	**AERONAUTICAL INFORMATION SERVICE**						
010 08 01 00	**Introduction**						
LO	State, in general terms, the objective of the Aeronautical Information Service.	x	x	x	x	x	x
010 08 02 00	**Definitions of ICAO Annex 15**						
LO	Recall the following definitions: Aeronautical Information Circular (AIC), Aeronautical Information Publication (AIP), AIP amendment, AIP supplement, AIRAC, danger area, Integrated Aeronautical Information Package, international airport, international NOTAM office (NOF), manoeuvring area, movement area, NOTAM, Pre-flight Information Bulletin (PIB), prohibited area, restricted area, SNOWTAM, ASHTAM.	x	x	x	x	x	x
010 08 03 00	**General**						
LO	State during which period of time aeronautical information service shall be available with reference to an aircraft flying in the area of responsibility of an AIS, provided a 24-hour service is not available.	x	x	x	x	x	x
LO	Name (in general) the kind of aeronautical information/data which an AIS service shall	x	x	x	x	x	x

	make available in a suitable form to flight crews.						
LO	Summarise the duties of aeronautical information service concerning aeronautical information data for the territory of the State.	x	x	x	x	x	x
LO	Understand the principles of WGS 84.	x	x	x	x	x	x
010 08 04 00	**Integrated Aeronautical Information Package**						
LO	Name the different elements that make up an Integrated Aeronautical Information Package.	x	x	x	x	x	x
010 08 04 01	**Aeronautical Information Publication (AIP)**						
LO	State the primary purpose of the AIP.	x	x	x	x	x	x
LO	Name the different parts of the AIP.	x	x	x	x	x	x
LO	State in which main part of the AIP the following information can be found: differences from the ICAO Standards, Recommended Practices and Procedures; location indicators, aeronautical information services, minimum flight altitude, VOLMET service, SIGMET service; general rules and procedures (especially general rules, VFR, IFR, ALT-setting procedure, interception of civil aircraft, unlawful interference, air traffic incidents); ATS airspace (especially FIR, UIR, TMA); ATS routes (especially lower ATS routes, upper ATS routes, area navigation routes); aerodrome data including aprons, TWYs and check locations/positions data; navigation warnings (especially prohibited, restricted and danger areas); aircraft instruments, equipment and flight documents; AD surface-movement guidance and control system and markings; RWY physical characteristics, declared distances, APP and RWY lighting; AD radio navigation and landing aids; charts related to an AD;	x	x	x	x	x	x

	entry, transit and departure of aircraft, passengers, crew and cargo.						
LO	State how permanent changes to the AIP shall be published.	x	x	x	x	x	x
LO	Explain what kind of information shall be published in the form of AIP Supplements.	x	x	x	x	x	x
LO	Describe how conspicuousness of AIP Supplement pages is achieved.	x	x	x	x	x	x
010 08 04 02	**NOTAMs**						
LO	Describe how information shall be published which in principle would belong to NOTAMs but includes extensive text and/or graphics.	x	x	x	x	x	x
LO	Summarise essential information which leads to the issuance of a NOTAM.	x	x	x	x	x	x
LO	State to whom NOTAMs shall be distributed.	x	x	x	x	x	x
LO	Explain how information regarding snow, ice and standing water on AD pavements shall be reported.	x	x	x	x	x	x
LO	Describe the means by which NOTAMs shall be distributed.	x	x	x	x	x	x
LO	State which information an ASHTAM may contain.	x	x	x	x	x	x
010 08 04 03	**Aeronautical Information Regulation and Control (AIRAC)**						
LO	List the circumstances under which the information concerned shall or should be distributed as AIRAC.	x	x	x	x	x	x
LO	State the sequence in which AIRACs shall be issued and state how many days before the effective date the information shall be distributed by AIS.	x	x	x	x	x	x
010 08 04 04	**Aeronautical Information Circulars (AICs)**						
LO	Describe the reasons for the publication of AICs.	x	x	x	x	x	x
LO	Explain the organisation and standard colour codes of AICs.	x	x	x	x	x	x
LO	Explain the normal publication cycle of AICs.	x	x	x	x	x	x
010 08 04 05	**Pre-flight and post-flight information/ data**						
LO	List (in general) which details shall be included in the aeronautical information provided for	x	x	x	x	x	x

	pre-flight planning purposes at the appropriate ADs.						
LO	Summarise the additional current information relating to the AD of departure that shall be provided as pre-flight information.	x	x	x	x	x	x
LO	Describe how a recapitulation of current NOTAM and other information of urgent character shall be made available to flight crews.	x	x	x	x	x	x
LO	State which post-flight information from aircrews shall be submitted to AIS for distribution as required by the circumstances.	x	x	x	x	x	x
010 09 00 00	**AERODROMES (ICAO Annex 14, Volume I — Aerodrome Design and Operations)**						
010 09 01 00	**General**						
LO	Recognise all definitions of ICAO Annex 14 except the following: accuracy, cyclic redundancy check, data quality, effective intensity, ellipsoid height (geodetic height), geodetic datum, geoid, geoid undulation, integrity (aeronautical data), light failure, lighting system reliability, orthometric height, station declination, usability factor, Reference code.	x	x	x	x	x	x
LO	Describe, in general terms, the intent of the AD reference code as well as its composition of two elements.	x	x	x	x	x	x
010 09 02 00	**Aerodrome data**						
010 09 02 01	**Aerodrome reference point**						
LO	Describe where the aerodrome reference point shall be located and where it shall normally remain.	x	x	x	x	x	x
010 09 02 02	**Pavement strengths**						
LO	Explain the terms PCN and ACN and describe their mutual dependence.	x	x	x	x	x	x
LO	Describe how the bearing strength for an aircraft with an apron mass equal to or less than 5 700 kg shall be reported.	x	x	x	x	x	x
010 09 02 03	**Declared distances**						
LO	List the four most important declared RWY distances and indicate where you can find	x	x	x	x	x	x

	guidance on their calculation in ICAO Annex 14.						
LO	Recall the definitions for the four main declared distances.	x	x	x	x	x	x
010 09 02 04	**Condition of the movement area and related facilities**						
LO	Understand the purpose of informing AIS and ATS units about the condition of the movement area and related facilities.	x	x	x	x	x	x
LO	List the matters of operational significance or affecting aircraft performance which should be reported to AIS and ATS units to be transmitted to aircraft involved.	x	x	x	x	x	x
LO	Describe the four different types of water deposit on runways.	x	x	x	x	x	x
LO	Name the three defined states of frozen water on the RWY.	x	x	x	x	x	x
LO	Understand the five levels of braking action including the associated coefficients and codes.	x	x	x	x	x	
010 09 03 00	**Physical characteristics**						
010 09 03 01	**Runways**						
LO	Describe where a threshold should normally be located.	x	x	x	x	x	x
LO	Acquaint yourself with the general considerations concerning runways associated with a stopway or clearway.	x	x	x	x	x	x
LO	State where in Annex 14 you can find detailed information about the required runway width dependent upon code number and code letter.	x	x	x	x	x	x
010 09 03 02	**Runway strips**						
LO	Explain the term ‘runway strip’.	x	x	x	x	x	x
010 09 03 03	**Runway-end safety area**						
LO	Explain the term ‘RWY-end safety area’.	x	x	x	x	x	x
010 09 03 04	**Clearway**						
LO	Explain the term ‘clearway’.	x	x	x	x	x	x
010 09 03 05	**Stopway**						
LO	Explain the term ‘stopway’.	x	x	x	x	x	x

010 09 03 06	**Radio-altimeter operating area**						
LO	Describe where a radio-altimeter operating area should be established and how far it should extend laterally and longitudinally.	x	x	x	x	x	x
010 09 03 07	**Taxiways**						
LO	Describe the condition which must be fulfilled to maintain the required clearance between the outer main wheels of an aircraft and the edge of the taxiway.	x	x	x	x	x	x
LO	Describe the reasons and the requirements for rapid-exit taxiways.	x	x	x	x	x	x
LO	State the reason for a taxiway widening in curves.	x	x	x	x	x	x
LO	Explain when and where holding bays should be provided.	x	x	x	x	x	x
LO	Describe where runway holding positions shall be established.	x	x	x	x	x	x
LO	Define the term 'road holding position'.	x	x	x	x	x	x
LO	Describe where intermediate taxiway holding positions should be established.	x	x	x	x	x	x
010 09 04 00	**Visual aids for navigation**						
010 09 04 01	**Indicators and signalling devices**						
LO	Describe the wind-direction indicators with which ADs shall be equipped.	x	x	x	x	x	x
LO	Describe a landing-direction indicator.	x	x	x	x	x	x
LO	Explain the capabilities of a signalling lamp.	x	x	x	x	x	x
LO	State which characteristics a signal area should have.	x	x	x	x	x	x
LO	Interpret all indications and signals that may be used in a signals area.	x	x	x	x	x	x
010 09 04 02	**Markings**						
LO	Name the colours used for the various markings (RWY, TWY, aircraft stands, apron safety lines).	x	x	x	x	x	x
LO	State where a RWY designation marking shall be provided and how it is designed.	x	x	x	x	x	x

LO	Describe the application and characteristics of: RWY-centre-line markings; THR marking; touchdown-zone marking; RWY-side-stripe marking; TWY-centre-line marking; runway holding position marking; intermediate holding position marking; aircraft-stand markings; apron safety lines; road holding position marking; mandatory instruction marking; information marking.	x	x	x	x	x	x
010 09 04 03	**Lights**						
LO	Describe mechanical safety considerations regarding elevated approach lights and elevated RWY, stopway and taxiway lights.	x	x	x	x	x	x
LO	Describe the relationship of the intensity of RWY lighting, the approach-lighting system and the use of a separate intensity control for different lighting systems.	x	x	x	x	x	x
LO	List the conditions for the installation of an AD beacon and describe its general characteristics.	x	x	x	x	x	x
LO	Name the different kinds of operations for which a simple APP lighting system shall be used.	x	x	x	x	x	x
LO	Describe the basic installations of a simple APP lighting system including the dimensions and distances normally used.	x	x	x	x	x	x
LO	Describe the principle of a precision APP category I lighting system including information such as location and characteristics. Remark: This includes the 'Calvert' system with additional crossbars.	x	x	x	x	x	x
LO	Describe the principle of a precision APP category II and III lighting system including information such as location and	x					

	characteristics, especially mentioning the inner 300 m of the system.						
LO	Describe the wing bars of PAPI and APAPI.	x	x	x	x	x	x
LO	Interpret what the pilot will see during approach using PAPI, APAPI, T-VASIS and AT-VASIS.	x	x	x	x	x	x
LO	Interpret what the pilot will see during approach using HAPI.			x	x	x	
LO	Explain the application and characteristics of: RWY-edge lights; RWY-threshold and wing-bar lights; RWY-end lights; RWY-centre-line lights; RWY-lead-in lights; RWY-touchdown-zone lights; stopway lights; taxiway-centre-line lights; taxiway-edge lights; stop bars; intermediate holding position lights; RWY-guard lights; road holding position lights.	x	x	x	x	x	x
LO	Understand the timescale within which aeronautical ground lights shall be made available to arriving aircraft.	x	x	x	x	x	
010 09 04 04	**Signs**						
LO	State the general purpose for installing signs.	x	x	x	x	x	x
LO	Explain which signs are the only ones on the movement area utilising red.	x	x	x	x	x	x
LO	List the provisions for illuminating signs.	x	x	x	x	x	x
LO	State the purpose for installing mandatory instruction signs.	x	x	x	x	x	x
LO	Name the kind of signs which shall be included in the mandatory instruction signs.	x	x	x	x	x	x
LO	Name the colours used for mandatory instruction signs.	x	x	x	x	x	x

LO	Describe by which sign a pattern 'A' runway-holding position (i.e. at an intersection of a taxiway and a non-instrument, non-precision approach or take-off RWY) marking shall be supplemented.	x	x	x	x	x	x
LO	Describe by which sign a pattern 'B' runway-holding position (i.e. at an intersection of a taxiway and a precision approach RWY) marking shall be supplemented.	x	x	x	x	x	x
LO	Describe the location of: a RWY designation sign at a taxiway/RWY intersection; a 'NO ENTRY' sign; a RWY holding position sign.	x	x	x	x	x	x
LO	Name the sign with which it shall be indicated that a taxiing aircraft is about to infringe an obstacle-limitation surface or to interfere with the operation of radio navigation aids (e.g. ILS/MLS critical/sensitive area).	x	x	x	x	x	x
LO	Describe the various possible inscriptions on RWY designation signs and on holding-position signs.	x	x	x	x	x	x
LO	Describe the inscription on an intermediate holding-position sign on a taxiway.	x	x	x	x	x	x
LO	State when information signs shall be provided.	x	x	x	x	x	x
LO	Describe the colours used in connection with information signs.	x	x	x	x	x	x
LO	Describe the possible inscriptions on information signs.	x	x	x	x	x	x
LO	Explain the application, location and characteristics of aircraft stand-identification signs.	x	x	x	x	x	x
LO	Explain the application, location and characteristics of road holding-position signs.	x	x	x	x	x	x
010 09 04 05	**Markers**						
LO	Explain why markers located near a runway or taxiway shall be limited to their height.	x	x	x	x	x	x
LO	Explain the application and characteristics of: unpaved RWY-edge markers;	x	x	x	x	x	x

	TWY-edge markers; TWY-centre-line markers; unpaved TWY-edge markers; boundary markers; stopway-edge markers.						
010 09 05 00	**Visual aids for denoting obstacles**						
010 09 05 01	**Marking of objects**						
LO	State how fixed or mobile objects shall be marked if colouring is not practicable.	x	x	x	x	x	x
LO	Describe marking by colours (fixed or mobile objects).	x	x	x	x	x	x
LO	Explain the use of markers for the marking of objects, overhead wires, cables, etc.	x	x	x	x	x	x
LO	Explain the use of flags for the marking of objects.	x	x	x	x	x	x
010 09 05 02	**Lighting of objects**						
LO	Name the different types of lights to indicate the presence of objects which must be lighted.	x	x	x	x	x	x
LO	State the time period(s) of the 24 hours of a day during which high-intensity lights are intended for use.	x	x	x	x	x	x
LO	Describe (in general terms) the location of obstacle lights.	x	x	x	x	x	x
LO	Describe (in general and for normal circumstances) the colour and sequence of low-intensity obstacle lights, medium-intensity obstacle lights and high-intensity obstacle lights.	x	x	x	x	x	x
LO	State where you can find information about lights to be displayed by aircraft.	x	x	x	x	x	x
010 09 06 00	**Visual aids for denoting restricted use of areas**						
LO	Describe the colours and meaning of 'closed markings' on RWYs and taxiways.	x	x	x	x	x	x
LO	State how the pilot of an aircraft moving on the surface of a taxiway, holding bay or apron shall be warned that the shoulders of these surfaces are 'non-load-bearing'.	x	x	x	x	x	x

LO	Describe the pre-threshold marking (including colours) when the surface before the threshold is not suitable for normal use by aircraft.	x	x	x	x	x	x
010 09 07 00	**Aerodromes operational services, equipment and installations**						
010 09 07 01	**Rescue and Firefighting (RFF)**						
LO	Name the principal objective of a rescue and firefighting service.	x	x	x	x	x	x
LO	List the most important factors bearing on effective rescue in a survivable aircraft accident.	x	x	x	x	x	x
LO	Explain the basic information the AD category (for rescue and firefighting) depends upon.	x	x	x	x	x	x
LO	Describe what is meant by the term ‘response time’ and state its normal and maximum limits.	x	x	x	x	x	x
LO	State the reasons for emergency-access roads and for satellite firefighting stations.	x	x	x	x	x	x
010 09 07 02	**Apron management service**						
LO	Describe the reason for providing a special apron management service and state what has to be observed if the AD control tower is not participating in the apron management service.	x	x	x	x	x	x
LO	State who has a right-of-way against vehicles operating on an apron.	x	x	x	x	x	x
010 09 07 03	**Ground-servicing of aircraft**						
LO	Describe the necessary actions during the ground-servicing of an aircraft with regard to the possible event of a fuel fire.	x	x	x	x	x	x
010 09 08 00	**Attachment A to ICAO Annex 14, Volume 1 — Supplementary Guidance Material**						
010 09 08 01	**Declared distances**						
LO	List the four types of ‘declared distances’ on a runway and also the appropriate abbreviations.	x	x	x	x	x	x
LO	Explain the circumstances which lead to the situation that the four declared distances on a runway are equal to the length of the runway.	x	x	x	x	x	x

LO	Describe the influence of a clearway, stopway and/or displaced threshold upon the four 'declared distances'.	x	x	x	x	x	x
010 09 08 02	**Radio-altimeter operating areas**						
LO	Describe the purpose of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the physical characteristics of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the dimensions of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the position of a radio-altimeter operating area.	x	x	x	x	x	x
010 09 08 03	**Approach lighting systems**						
LO	Name the two main groups of approach lighting systems.	x	x	x	x	x	x
LO	Describe the two different versions of a simple approach lighting system.	x	x	x	x	x	x
LO	Describe the two different basic versions of precision approach lighting systems for CAT I.	x	x	x	x	x	x
LO	Describe the diagram of the inner 300 m of the precision approach lighting system in the case of CAT II and III.	x					
LO	Describe how the arrangement of an approach lighting system and the location of the appropriate threshold are interrelated between each other.	x	x	x	x	x	x
010 10 00 00	**FACILITATION (ICAO Annex 9)**						
010 10 01 00	**General**						
010 10 01 01	**Foreword**						
LO	Explain the aim of ANNEX 9 as indicated in the Foreword.	x	x	x	x	x	
010 10 01 02	**Definitions (ICAO Annex 9)**						
LO	Understand the definitions.	x	x	x	x	x	
010 10 02 00	**Entry and departure of aircraft**						
010 10 02 01	**General Declaration**						
LO	Describe the purpose and use of aircraft documents — as far as the 'General Declaration' is concerned.	x	x	x	x	x	

LO	State whether or not a 'General Declaration' will be required by a Contracting State under normal circumstances.	x	x	x	x	x	
LO	State the kind of information concerning crew members whenever a 'General Declaration' is required by a Contracting State.	x	x	x	x	x	
010 10 02 02	**Entry and departure of crew**						
LO	Explain entry requirements for crew.	x	x	x	x	x	
LO	Explain the reasons for the use of Crew Member Certificates (CMC) for flight crews and cabin attendants engaged in International Air Transport.	x	x	x	x	x	
LO	Explain in which cases Contracting States shall accept the CMC as an identity document instead of a passport or visa.	x	x	x	x	x	
LO	State whether the entry privileges for crews of scheduled international air services can be extended to other flight crews of aircraft operated for remuneration or hire but not engaged in scheduled International Air Services.	x	x	x	x	x	
010 10 02 03	**Entry and departure of passengers and baggage**						
LO	Explain the entry requirements for passengers and their baggage.	x	x	x	x	x	
LO	Explain the requirements and documentation for unaccompanied baggage.	x	x	x	x	x	
LO	Be familiar with the documentation required for the departure and entry of passengers and their baggage.	x	x	x	x	x	
LO	Be familiar with the arrangements in the event of a passenger being declared an inadmissible person.	x	x	x	x	x	
LO	Describe the pilots authority towards unruly passengers.	x	x	x	x	x	
010 10 02 04	**Entry and departure of cargo**						
LO	Explain entry requirements for cargo.						
LO	Be familiar with the documentation required for the entry and departure of cargo.	x	x	x	x	x	
010 11 00 00	**SEARCH AND RESCUE**						

010 11 01 00	**Essential Search and Rescue (SAR) definitions in ICAO Annex 12**						
LO	Define the following: alert phase, distress phase, emergency phase, operator, pilot-in-command, rescue co-ordination centre, State of registry, uncertainty phase.	x	x	x	x	x	
010 11 02 00	**Organisation**						
LO	Describe how Contracting States shall arrange for the establishment and prompt provisions of SAR services.	x	x	x	x	x	
LO	Explain the establishment of SAR Regions by Contracting States.	x	x	x	x	x	
LO	Describe the areas within which SAR services shall be established by Contracting States.	x	x	x	x	x	
LO	State the period of time per day within which SAR services shall be available.	x	x	x	x	x	
LO	Describe for which areas rescue coordination centres shall be established.	x	x	x	x	x	
010 11 03 00	**Operating procedures for non-SAR crews**						
LO	Explain the SAR operating procedures for the pilot-in-command who arrives first at the scene of an accident.	x	x	x	x	x	
LO	Explain the SAR operating procedures for the pilot-in-command intercepting a distress transmission.	x	x	x	x	x	
010 11 04 00	**Search and rescue signals**						
LO	Explain the 'ground–air visual signal code' for use by survivors.	x	x	x	x	x	
LO	Explain the signals to be used for 'air–ground signals'.	x	x	x	x	x	
010 12 00 00	**SECURITY**						
010 12 01 00	**Essential definitions of ICAO Annex 17**						
LO	Define the following terms: airside, aircraft security check, screening, security, security control, security-restricted area, unidentified baggage.	x	x	x	x	x	
010 12 02 00	**General principles**						
LO	State the objectives of security.	x	x	x	x	x	

LO	Explain where further information in addition to ICAO Annex 17 concerning aviation security is available.	x	x	x	x	x	
010 12 03 00	**Organisation**						
LO	Understand the required activities expected at each airport serving international civil aviation.	x	x	x	x	x	
010 12 04 00	**Preventive security measures**						
LO	Describe the objects not allowed (for reasons of aviation security) on board an aircraft engaged in international civil aviation.	x	x	x	x	x	
LO	Explain what each Contracting State is supposed to do concerning originating passengers and their cabin baggage prior to boarding an aircraft engaged in international civil aviation operations.	x	x	x	x	x	
LO	State what each Contracting State is supposed to do if passengers subjected to security control have mixed after a security screening point.	x	x	x	x	x	
LO	Explain what has to be done at airports serving international civil aviation to protect cargo, baggage, mail stores and operator supplies against an act of unlawful interference.	x	x	x	x	x	
LO	Explain what has to be done when passengers, who are obliged to travel because of judicial or administrative proceedings, are supposed to board an aircraft.	x	x	x	x	x	
LO	Understand what has to be considered if law-enforcement officers carry weapons on board.	x	x	x	x	x	
LO	Describe what is meant by ‘access control’ at an aerodrome.	x	x	x	x	x	
010 12 05 00	**Management of response to acts of unlawful interference**						
LO	Describe the assistance each Contracting State shall provide to an aircraft subjected to an act of unlawful seizure.	x	x	x	x	x	
LO	State the circumstances which could prevent a State to detain an aircraft on the ground after being subjected to an act of unlawful seizure.	x	x	x	x	x	
010 12 06 00	**Operators’ security programme**						

LO	Understand the principles of the written operator security programme each Contracting State requires from operators.	x	x	x	x	x	
010 12 07 00	**Security procedures in other documents, i.e. ICAO Annex 2, ICAO Annex 6, ICAO Annex 14, ICAO Doc 4444**						
010 12 07 01	**ICAO Annex 2 — Rules of the Air, Attachment B — Unlawful interference**						
LO	Describe what the PIC should do unless considerations on board the aircraft dictate otherwise.	x	x	x	x	x	
LO	Describe what the PIC should do if: the aircraft must depart from its assigned track; the aircraft must depart from its assigned cruising level; the aircraft is unable to notify an ATS unit of the unlawful interference.	x	x	x	x	x	
LO	Describe what the PIC should attempt to do with regard to broadcast warnings to decide at which level the crew is proceeding if no applicable regional procedures for in-flight contingencies have been established.	x	x	x	x	x	
010 12 07 02	**ICAO Annex 6, Chapter 13 — Security**						
LO	Describe the special considerations referring to flight crew compartment doors with regard to aviation security.	x	x	x	x	x	
LO	Explain what an operator shall do to minimise the consequences of acts of unlawful interference.	x	x	x	x	x	
LO	Explain what an operator shall do to have appropriate employees available who can contribute to the prevention of acts of sabotage or other forms of unlawful interference.	x	x	x	x	x	
010 12 07 03	**ICAO Annex 14, Chapter 3 — Physical characteristics**						
LO	Describe what minimum distance an isolated aircraft parking position (after the aircraft has been subjected to unlawful interference) should have from other parking positions, buildings or public areas.	x	x	x	x	x	

010 12 07 04	**ICAO Doc 4444**						
LO	Describe the considerations that must take place with regard to a taxi clearance in case an aircraft is known or believed to have been subjected to unlawful interference.	x	x	x	x	x	
010 13 00 00	**AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION**						
010 13 01 00	**Essential definitions of ICAO Annex 13**						
LO	Define the following: accident, aircraft, flight recorder, incident, investigation, maximum mass, operator, serious incident, serious injury, State of Design, State of Manufacture, State of Occurrence, State of the Operator, State of Registry.	x	x	x	x	x	
LO	Define the difference between 'serious incident' and 'accident'.	x	x	x	x	x	
LO	Determine whether a certain occurrence has to be defined as a serious incident or as an accident.	x	x	x	x	x	
LO	Recognise the description of an accident or incident.	x	x	x	x	x	
010 13 02 00	**Applicability of ICAO Annex 13**						
LO	Describe the geographical limits, if any, within which the specifications given in Annex 13 apply.	x	x	x	x	x	
010 13 03 00	**ICAO accident and incident investigation**						
LO	State the objective(s) of the investigation of an accident or incident according to Annex 13.	x	x	x	x	x	
LO	Understand the general procedures for the investigation of an accident or incident according to Annex 13.	x	x	x	x	x	
010 13 04 00	**Accident and incident investigation in accordance with EU documents**						
LO	Be familiar with Council Directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents.	x	x	x	x	x	
LO	Be familiar with Council Directive 2003/42/EC of the European Parliament and of the Council	x	x	x	x	x	

	of 13 June 2003 on occurrence reporting in civil aviation.						
LO	Be familiar with the differences between the procedures for accident and incident investigation in EU regulations compared to ICAO Annex 13.	x	x	x	x	x	
010 14 00 00	**Regulation (EC) No 216/2008 (the Basic Regulation)**						
010 14 01 00	**Definitions**						
LO	Certificate, commercial operation, complex motor-powered aircraft, flight simulation training device and rating.	x	x	x	x	x	
010 14 02 00	**Applicability**						
LO	Explain the applicability of the Basic Regulation.	x	x	x	x	x	

B. SUBJECT 021 — AIRFRAME AND SYSTEMS, ELECTRICS, POWER PLANT AND EMERGENCY EQUIPMENT

[

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/IR	ATPL	CPL	
020 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE**						
021 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — AIRFRAME AND SYSTEMS, ELECTRICS, POWER PLANT, EMERGENCY EQUIPMENT**						
021 01 00 00	**SYSTEM DESIGN, LOADS, STRESSES, MAINTENANCE**						
021 01 01 00	**System design**						
021 01 01 01	**Design concepts**						
LO	Describe the following structural design philosophy: safe life; fail-safe (multiple load paths); damage-tolerant.	x	x	x	x	x	
LO	Describe the following system design philosophy: redundancy.	x	x	x	x	x	
021 01 01 02	**Level of certification**						

LO	Explain and state the safety objectives associated with failure conditions (AMC 25.1309, Fig. 2).	x					
LO	Explain the relationship between the probability of a failure and the severity of the failure effects.	x		x	x		
LO	Explain why some systems are duplicated or triplicated.	x		x	x		
021 01 02 00	**Loads and stresses**						
LO	Explain the following terms: stress, strain, tension, compression, buckling, bending, torsion, static loads, dynamic loads, cyclic loads, elastic and plastic deformation.	x	x	x	x	x	
	Remark: Stress is the internal force per unit area inside a structural part as a result of external loads. Strain is the deformation caused by the action of stress on a material. It is normally given as the change in dimension expressed in a percentage of the original dimensions of the object.						
LO	Describe the relationship between stress and strain for a metal.	x	x	x	x	x	
021 01 03 00	**Fatigue**						
LO	Describe the phenomenon of fatigue.	x	x	x	x	x	
LO	Explain the relationship between the magnitude of the alternating stress and the number of cycles (S/N diagram or Wöhler curve).	x	x	x	x	x	
LO	Explain the implication of stress-concentration factor.	x	x	x	x	x	
021 01 04 00	**Corrosion**						

LO	Describe the following types of corrosion: oxidation, electrolytic.	x	x	x	x	x	
LO	Describe the interaction between fatigue and corrosion (stress corrosion).	x	x	x	x	x	
021 01 05 00	**Maintenance**						
021 01 05 01	**Maintenance methods: hard time and on condition**						
LO	Explain the following terms: hard-time maintenance; on-condition maintenance.	x	x	x	x	x	
021 02 00 00	**AIRFRAME**						
021 02 01 00	**Construction and attachment methods**						
LO	Describe the principles of the following construction methods: monocoque; semi-monocoque; cantilever; sandwich, including honey comb; truss.	x	x	x	x	x	
LO	Describe the following attachment methods: riveting, welding, bolting, pinning, adhesives (bonding).	x	x	x	x	x	
LO	State that sandwich structural parts need additional provisions to carry concentrated loads.	x	x	x	x	x	
021 02 02 00	**Materials**						

LO	Explain the following material properties: elasticity, plasticity, stiffness, strength, strength-to-density ratio.	x	x	x	x	x	
LO	Compare the above properties as they apply to aluminium alloys, magnesium alloys, titanium alloys, steel and composites.	x	x	x	x	x	
LO	Explain the need to use alloys rather than pure metals.	x	x	x	x	x	
LO	Explain the principle of a composite material.	x	x	x	x	x	
LO	Describe the function of the following components: matrix, resin or filler; fibres.	x	x	x	x	x	
LO	State the advantages and disadvantages of composite materials compared with metal alloys by considering the following: strength-to-weight ratio; capability to tailor the strength to the direction of the load; stiffness; electrical conductivity (lightning); resistance to fatigue; resistance to corrosion and cost.	x	x	x	x	x	
LO	State that the following are composite-fibre materials: carbon, glass, aramid (Kevlar).	x	x	x	x	x	
021 02 03 00	**Aeroplane: wings, tail surfaces and control surfaces**						
021 02 03 01	**Design and construction**						

LO	Describe the following types of construction: cantilever, non-cantilever (braced).	x	x				
021 02 03 02	**Structural components**						
LO	Describe the function of the following structural components: spar and its components (web and girder or cap), rib, stringer, skin, torsion box.	x	x				
021 02 03 03	**Loads, stresses and aeroelastic vibrations ('flutter')**						
LO	Describe the vertical and horizontal loads on the ground.	x	x				
LO	Describe the loads in flight for symmetrical and asymmetrical conditions, considering both vertical and horizontal loads and loads due to engine failure.	x	x				
LO	Describe the principle of flutter, flutter damping and resonance for the wing and control surfaces.	x	x				
LO	Explain the significance on stress relief and flutter of the following: chord-wise and span-wise position of masses (e.g. engines, fuel and balance masses, control balance masses); torsional stiffness; bending flexibility.	x	x				
LO	Describe the following design configurations: conventional (low or mid set) tailplane; T-tail.	x	x				
021 02 04 00	**Fuselage, landing gear, doors, floor, windscreen and windows**						
LO	Describe the following types of fuselage construction: monocoque, semi-monocoque.	x	x	x	x	x	

LO	Describe the construction and the function of the following structural components of a fuselage: frames; bulkhead; stiffeners, stringers, longerons; skin, doublers; floor suspension (crossbeams); floor panels; firewall.	x	x	x	x	x	
LO	Describe the loads on the fuselage due to pressurisation.	x	x				
LO	Describe the following loads on a main landing gear: touch-down loads (vertical and horizontal) taxi loads on bogie gear (turns).	x	x				
LO	Describe the structural danger of a nose-wheel landing with respect to: fuselage loads; nose-wheel strut loads.	x	x				
LO	Describe the structural danger of a tail strike with respect to: fuselage and aft bulkhead damage (pressurisation).	x	x				
LO	Describe the door and hatch construction for pressurised and unpressurised aeroplanes including: door and frame (plug type); hinge location; locking mechanism.	x	x				
LO	Explain the advantages and disadvantages of the following fuselage cross sections: circular; double bubble (two types); oval; rectangular.	x	x				

LO	State that flight-deck windows are constructed with different layers.	x	x				
LO	Explain the function of window heating for structural purposes.	x	x				
LO	Explain the implication of a direct-vision window (see CS 25.773(b)(3)).	x	x				
LO	State the need for an eye-reference position.	x	x				
LO	Explain the function of floor venting (blow-out panels).	x	x				
LO	Describe the construction and fitting of sliding doors.			x	x	x	
021 02 05 00	**Helicopter: flight controls structural aspects**						
021 02 05 01	**Design and construction**						
LO	List the functions of flight controls.			x	x	x	
LO	Describe and explain the different flight control design concepts for conventional, tandem, coaxial, side by side, NOTAR and Fenestron-equipped helicopters.			x	x	x	
LO	Explain the advantages, disadvantages and limitations of the respective designs above.			x	x	x	
LO	Explain the function of the synchronised elevator.			x	x	x	
LO	Describe the construction methods and alignment of vertical and horizontal stabilisers.			x	x	x	
021 02 05 02	**Structural components and materials**						
LO	Name the main components of flight and control surfaces.			x	x	x	
LO	Describe the fatigue life and methods of checking for serviceability of flight and control surface components and materials.			x	x	x	
021 02 05 03	**Loads, stresses and aeroelastic vibrations**						
LO	Describe and explain where the main stresses are applied to components.			x	x	x	
LO	Describe the dangers and stresses regarding safety and serviceability in flight when the manufacturer's design envelope is exceeded.			x	x	x	

LO	Explain the procedure for: static chord-wise balancing; static span-wise balancing; blade alignment; dynamic chord-wise balancing; dynamic span-wise balancing.			x	x	x	
LO	Explain the process of blade tracking including: the pre-track method of blade tracking; the use of delta incidence numbers; aircraft configuration whilst carrying out tracking; factors affecting blade-flying profile; ground tracking and in-flight trend analysis; use of pitch-link and blade-trim tab adjustments; tracking techniques, including stroboscopic and electronic.			x	x	x	
LO	Describe the early indications and vibrations which are likely to be experienced when the main rotor blades and tail rotor are out of balance and/or tracking, including the possible early indications due to possible fatigue and overload.			x	x	x	
LO	Explain how a vibration harmonic can be set up in other components which can lead to their early failure.			x	x	x	
LO	Describe the three planes of vibration measurement, i.e. vertical, lateral, fore and aft.			x	x	x	
021 02 06 00	**Structural limitations**						
LO	Define and explain the following maximum structural masses: maximum ramp mass; maximum take-off mass; maximum zero-fuel mass; maximum landing mass. Remark: These limitations may also be found in the relevant part of subjects 031, 032 and 034.	x	x				
LO	Explain that airframe life is limited by fatigue, created by alternating stress and the number of load cycles.	x	x				

LO	Explain the maximum structural masses: maximum take-off mass.			x	x	x	
LO	Explain that airframe life is limited by fatigue, created by load cycles.			x	x	x	
021 03 00 00	**HYDRAULICS**						
021 03 01 00	**Hydromechanics: basic principles**						
LO	Explain the concept and basic principles of hydromechanics including: hydrostatic pressure; Pascal's law; the relationship between pressure, force and area; transmission of power: multiplication of force, decrease of displacement.	x	x	x	x	x	
021 03 02 00	**Hydraulic systems**						
021 03 02 01	**Hydraulic fluids: types, characteristics, limitations**						
LO	List and explain the desirable properties of a hydraulic fluid: thermal stability; corrosiveness; flashpoint and flammability; volatility; viscosity.	x	x	x	x	x	
LO	State that hydraulic fluids are irritating for skin and eyes.	x	x	x	x	x	
LO	List the two different types of hydraulic fluids: synthetic, mineral.	x	x	x	x	x	
LO	State that different types of hydraulic fluids cannot be mixed.	x	x	x	x	x	
LO	State that at the pressures being considered, hydraulic fluid is considered incompressible.	x	x	x	x	x	
021 03 02 02	**System components: design, operation, degraded modes of operation, indications and warnings**						
LO	Explain the working principle of a hydraulic system.	x	x	x	x	x	

LO	Describe the difference in principle of operation between a constant pressure system and a system pressurised only on specific demand (open-centre).	x	x	x	x	x	
LO	State the differences in principle of operation between a passive hydraulic system (without a pressure pump) and an active hydraulic system (with a pressure pump).	x	x	x	x	x	
LO	List the main advantages and disadvantages of system actuation by hydraulic or purely mechanical means with respect to: weight, size, force.	x	x	x	x	x	
LO	List the main users of hydraulic systems.	x	x	x	x	x	
LO	State that hydraulic systems can be classified as either high pressure (typically 3 000 psi or higher) and low pressure (typically up to 2 000 psi).	x	x	x	x	x	
LO	State that the normal hydraulic pressure of most large transport aircraft is 3 000 psi.	x	x	x	x	x	
LO	Explain the working principle of a low-pressure (0–2000 psi) open centred system using an off loading valve and an RPM dependent pump.	x	x	x	x	x	
LO	Explain the advantages and disadvantages of a high pressure system over a low -pressure system.	x	x	x	x	x	
LO	Describe the working principle and functions of pressure pumps including: constant pressure pump (swash plate or cam plate); pressure pump whose output is dependent on pump RPM (gear type).	x	x	x	x	x	
LO	State that for an aeroplane, the power sources of a hydraulic pressure pump can be: manual; engine gearbox; electrical; air (pneumatic and ram-air turbine); hydraulic (power transfer unit) or reversible motor pumps.	x	x				

LO	State that for a helicopter, the power sources of a hydraulic pressure pump can be: manual, engine, gearbox, electrical.			x	x	x	
LO	Describe the working principle and functions of the following hydraulic-system components: reservoir (pressurised and unpressurised); accumulators; case drain lines and fluid cooler return lines; piston actuators (single and double acting); hydraulic motors; filters; non-return (check) valves; relief valves; restrictor valves; elector valves (linear and basic rotary selectors, two and four ports); bypass valves; shuttle valves; fire shut-off valves; priority valves; fuse valves; pressure and return pipes.	x	x	x	x	x	
LO	Explain why many transport aeroplanes have ‘demand’ hydraulic pumps.	x	x				
LO	Explain how redundancy is obtained by giving examples.	x	x	x	x	x	
LO	Interpret the hydraulic system schematic appended to these LOs (to be introduced at a later date).	x	x	x	x	x	
LO	Explain the implication of a high system demand.	x	x	x	x	x	
LO	Explain the implication of a system internal leakage including hydraulic lock of piston actuators.	x	x	x	x	x	

LO	List and describe the instruments and alerts for monitoring a hydraulic system.	x	x	x	x	x	
LO	State the indications and explain the implications of the following malfunctions: system leak or low level; low pressure; high temperature.	x	x	x	x	x	
021 04 00 00	**LANDING GEAR, WHEELS, TYRES, BRAKES**						
021 04 01 00	**Landing gear**						
021 04 01 01	**Types**						
LO	Name, for an aeroplane, the following different landing-gear configurations: nose wheel, tail wheel.	x	x				
LO	Name, for a helicopter, the following different landing-gear configurations: nose wheel, tail wheel, skids.			x	x	x	
021 04 01 02	**System components, design, operation, indications and warnings, on-ground/in-flight protections, emergency extension systems**						
LO	Explain the function of the following components of a landing gear: oleo leg/shock strut; axles; bogies and bogie beam; drag struts; side stays/struts; torsion links; locks (over centre); gear doors and retraction mechanisms (normal and emergency operation).	x	x				
LO	Explain the function of the following components of a landing gear: oleo leg/shock strut; axles; drag struts; side stays/struts; torsion links; locks (over centre); gear doors and retraction mechanisms (normal and emergency operation).			x	x	x	
LO	Name the different components of a landing gear, using the diagram appended to these LOs.	x	x				

LO	Describe the sequence of events of the landing gear during normal operation.	x	x	x	x	x	
LO	State how landing-gear position indication and alerting is implemented.	x	x	x	x	x	
LO	Describe the various protection devices to avoid inadvertent gear retraction on the ground: ground lock (pins); protection devices in the gear-retraction mechanism.	x	x	x	x	x	
LO	Explain the speed limitations for gear operation (VLO and VLE).	x	x				
LO	Describe the sequence for emergency gear extension: unlocking; operating; down-locking.	x	x	x	x	x	
	Describe some methods for emergency gear extension including: gravity/free fall; air or nitrogen pressure; manually/mechanically.	x	x	x	x	x	
021 04 02 00	**Nose-wheel steering: design, operation**						
LO	Explain the operating principle of nose-wheel steering.	x	x	x	x	x	
LO	Explain, for a helicopter, the functioning of differential braking with free-castoring nose wheel.			x	x	x	
LO	Describe, for an aeroplane, the functioning of the following systems: differential braking with free-castoring nose wheel; tiller or hand wheel steering; rudder pedal nose-wheel steering.	x	x				
LO	Explain the centring mechanism of the nose wheel.	x	x				
LO	Define the term ‘shimmy’ and the possible consequences for the nose and the main-wheel system.	x	x	x	x	x	
LO	Explain the purpose of main-wheel (body) steering.	x	x				
021 04 03 00	**Brakes**						
021 04 03 01	**Types and materials**						

LO	Describe the basic operating principle of a disk brake.	x	x	x	x	x	
LO	State the different materials used in a disc brake (steel, carbon).	x	x	x	x	x	
LO	Describe their characteristics, advantages and disadvantages such as: weight; temperature limits; internal-friction coefficient; wear.	x	x	x	x	x	
021 04 03 02	**System components, design, operation, indications and warnings**						
LO	State the limitation of brake energy and describe the operational consequences.	x	x				
LO	Explain how brakes are actuated.	x	x	x	x	x	
LO	Identify the task of an auto-retract or in-flight brake system.	x	x				
LO	State that brakes can be torque-limited.	x	x				
LO	Describe the function of a brake accumulator.	x	x	x	x	x	
LO	Describe the function of the parking brake.	x	x	x	x	x	
LO	Explain the function of wear indicators.	x	x				
LO	Explain the reason for the brake-temperature indicator.	x	x				
LO	State that the main power source for brakes in normal operation and for alternate operation for large transport aeroplanes is hydraulic.	x	x				
021 04 03 03	**Anti-skid**						
LO	Describe the operating principle of an anti-skid system where the brake performance is based on maintaining the optimum wheel-slip value.	x	x				
LO	Explain the purpose of the wheel-speed signal (tachometer) and of the aeroplane reference speed signal to the anti-skid computer, considering: slip ratio for maximum braking performance; locked-wheel prevention (protection against deep skid on one wheel); touchdown protection (protection against brake-pressure application during touchdown); hydroplane protection.	x	x				
LO	Give examples of the impact of an anti-skid system on performance.	x	x				

021 04 03 04	**Autobrake**						
LO	Describe the operating principle of an autobrake system.	x	x				
LO	State that the anti-skid system must be available when using autobrakes.	x	x				
LO	Explain the difference between the three possible levels of operation of an autobrake system: OFF (system off or reset); Arm/Disarm (arm: the system is ready to operate under certain conditions); Operative/Inoperative or Activated/ Deactivated (application of pressure on brakes).	x	x				
021 04 04 00	**Wheels, rims and tyres**						
021 04 04 01	**Types, structural components and materials, operational limitations, thermal plugs**						
LO	Describe the different types of tyres such as: tubeless; diagonal (cross ply); radial (circumferential bias).	x	x	x	x	x	
LO	Define the following terms: ply rating; tyre tread; tyre creep; retread (cover).	x	x	x	x	x	
LO	Explain the function of thermal/fusible plugs.	x	x				
LO	Explain the implications of tread separation and tyre burst.	x	x				
LO	State that the ground speed of tyres is limited.	x	x				
LO	Describe material and basic construction of the rim of an aeroplane wheel.	x	x				
021 04 05 00	**Helicopter equipment**						
LO	Explain flotation devices and how they are operated.			x	x	x	
LO	Explain the IAS limitations before, during and after flotation-device deployment.			x	x	x	
021 05 00 00	**FLIGHT CONTROLS**						
021 05 01 00	**Aeroplane: primary flight controls**						

	Remark: The manual, irreversible and reversible flight control systems as discussed in 021 05 01 01, 05 01 02 and 05 01 03 are all considered to be mechanical flight control systems. Fly-by-wire flight control systems are discussed in 021 05 04 00.						
LO	Define a 'primary flight control'.	x	x				
LO	List the following primary flight control surfaces: elevator; aileron, roll spoilers; rudder.	x	x				
LO	List the various means of control surface actuation including: manual; fully powered (irreversible); partially powered (reversible).	x	x				
021 05 01 01	**Manual controls**						
LO	Explain the basic principle of a fully manual control system.	x	x				
021 05 01 02	**Fully powered controls (irreversible)**						
LO	Explain the basic principle of a fully powered control system.	x					
LO	Explain the concept of irreversibility in a flight control system.	x					
LO	Explain the need for a 'feel system' in a fully powered control system.	x					
LO	Explain the operating principle of a stabiliser trim system in a fully powered control system.	x					
LO	Explain the operating principle of rudder and aileron trim in a fully powered control system.	x					
021 05 01 03	**Partially powered controls (reversible)**						
LO	Explain the basic principle of a partially powered control system.	x	x				
LO	Explain why a 'feel system' is not necessary in a partially powered control system.	x	x				
021 05 01 04	**System components, design, operation, indications and warnings, degraded modes of operation, jamming**						

LO	List and describe the function of the following components of a flight control system: actuators; control valves; cables or electrical wiring; control surface position sensors.	x	x				
LO	Explain how redundancy is obtained in primary flight control systems of large transport aeroplanes.	x	x				
LO	Explain the danger of control jamming and the means of retaining sufficient control capability.	x	x				
LO	Explain the methods of locking the controls on the ground and describe 'gust or control lock' warnings.	x	x				
LO	Explain the concept of a rudder-deflection limitation (rudder limiter) system and the various means of implementation (rudder ratio changer, variable stops, blow-back).	x	x				
021 05 02 00	**Aeroplane: secondary flight controls**						
021 05 02 01	**System components, design, operation, degraded modes of operation, indications and warnings**						
LO	Define a 'secondary flight control'.	x	x				
	List the following secondary flight control surfaces: lift-augmentation devices (flaps and slats); speed brakes; flight and ground spoilers; trimming devices such as trim tabs, trimmable horizontal stabiliser.	x	x				
LO	Describe secondary flight control actuation methods and sources of actuating power.	x	x				
LO	Explain the function of a mechanical lock when using hydraulic motors driving a screw jack.	x	x				
LO	Describe the requirement for limiting speeds for the various secondary flight control surfaces.	x	x				
LO	For lift-augmentation devices, explain the load-limiting (relief) protection devices and the functioning of an autoretraction system.	x	x				

LO	Explain how a flap/slat asymmetry protection device functions.	x	x				
LO	Describe the function of an autoslat system.	x	x				
LO	Explain the concept of control surface blow-back (aerodynamic forces overruling hydraulic forces).	x	x				
021 05 03 00	**Helicopter: flight controls**						
LO	Explain the methods of locking the controls on the ground.			x	x	x	
LO	Describe main-rotor droop stops and how static rotor flapping is restricted.			x	x	x	
LO	Describe the need for linear and rotary control input/output.			x	x	x	
LO	Explain the principle of phase lag and advance angle.			x	x	x	
LO	Describe the following four axes of control operation, their operating principle and their associated cockpit controls: collective control; cyclic fore and aft (pitch axis); cyclic lateral (roll axis); yaw.			x	x	x	
LO	Describe the swash plate or azimuth star control system including the following: swash plate inputs; the function of the non-rotating swash plate; the function of the rotating swash plate; how swash plate tilt is achieved; swash plate pitch axis; swash plate roll axis; balancing of pitch/roll/collective inputs to the swash plate to equalise torsional loads on the blades.			x	x	x	
LO	Describe the main-rotor spider control system including the following: the collective beam; pitch/roll/collective inputs to the collective beam; spider drive.			x	x	x	

LO	Describe the need for control system interlinks, in particular: collective/yaw; collective/throttle; cyclic/stabilator; interaction between cyclic controls and horizontal/stabilator.			x	x	x	
LO	State the need for 'feel systems' in the hydraulic actuated flight control system.			x	x	x	
LO	Describe the purpose of a trim system.			x	x	x	
LO	Describe the purpose of a cyclic beep-trim system that utilises parallel trim actuators to enable the pilot to control the aircraft.			x	x	x	
LO	List and describe the different types of trim systems.			x	x	x	
LO	Explain the basic components of a trim system, in particular: force-trim switch; force gradient; parallel trim actuator; cyclic 4-way trim switch; interaction of trim system with an SAS/SCAS/ASS stability system; trim-motor indicators.			x	x	x	
LO	Describe the different types of control runs.			x	x	x	
LO	Explain the use of control stops.			x	x	x	
021 05 04 00	**Aeroplane: Fly-by-Wire (FBW) control systems**						

LO	Explain that a FBW flight control system is composed of the following: pilot’s input command (control stick/column); electrical signalling, including: pilot input to computer; computer to flight control surfaces; feedback from aircraft response to computer; flight control computers; actuators; control surfaces.	x	x				
LO	State the advantages and disadvantages of a FBW system in comparison with a conventional flight control system including: weight; pilot workload; flight-envelope protection.	x	x				
LO	Explain why a FBW system is always irreversible.	x	x				
LO	State the existence of degraded modes of operation.	x	x				
021 05 05 00	**Helicopter: Fly-by-Wire (FBW) control systems**						
LO	To be introduced at a later date.			x	x	x	
021 06 00 00	**PNEUMATICS — PRESSURISATION AND AIR-CONDITIONING SYSTEMS**						
021 06 01 00	**Pneumatic/bleed air supply**						
021 06 01 01	**Piston-engine air supply**						
LO	State the method of supplying air for the pneumatic systems for piston engine aircraft.	x	x	x	x	x	
LO	State that air supply is required for the following systems: instrumentation, heating, de-icing.	x	x	x	x	x	
021 06 01 02	**Gas turbine engine: bleed air supply**						

LO	State that the possible bleed air sources for gas turbine engine aircraft are the following: engine, APU, ground supply.	x	x	x	x	x	
LO	State that for an aeroplane a bleed air supply can be used for the following systems or components: anti-icing; engine air starter; pressurisation of a hydraulic reservoir; air-driven hydraulic pumps; pressurisation and air conditioning.	x	x				
LO	State that for a helicopter a bleed air supply can be used for the following systems or components: anti-icing; engine air starter; pressurisation of a hydraulic reservoir.			x	x	x	
LO	State that the bleed air supply system can comprise the following: pneumatic ducts; isolation valve; pressure-regulating valve; engine bleed valve (HP/IP valves); fan-air pre-cooler; temperature and pressure sensors.	x	x	x	x	x	
LO	Interpret the pneumatic system schematic appended to these LOs (to be introduced at a later date).	x	x	x	x	x	
LO	Describe the cockpit indications for bleed air systems.	x	x	x	x	x	
LO	State how the bleed air supply system is controlled and monitored.	x	x	x	x	x	

LO	List the following air bleed malfunctions: over-temperature; over-pressure; low pressure; overheat/duct leak.	x	x	x	x	x	
021 06 02 00	**Helicopter: air-conditioning systems**						
021 06 02 01	**Types, system components, design, operation, degraded modes of operation, indications and warnings**						
LO	Describe the purpose of an air-conditioning system.			x	x	x	
LO	Explain how an air-conditioning system is controlled.			x	x	x	
LO	Describe the vapour cycle air-conditioning system including system components, design, operation, degraded modes of operation and system malfunction indications.			x	x	x	
LO	Identify the following components from a diagram of an air-conditioning system and describe the operating principle and function: air-cycle machine (pack, bootstrap system); pack-cooling fan; water separator; mixing valves; flow-control valves; isolation valves; recirculation fans; filters for recirculation; temperature sensors.			x	x	x	
LO	List and describe the controls, indications and warnings related to an air-conditioning system.			x	x	x	
021 06 03 00	**Aeroplane: pressurisation and air-conditioning system**						
021 06 03 01	**System components, design, operation, degraded modes of operation, indications and warnings**						

LO	State that a pressurisation and an air-conditioning system of an aeroplane controls: ventilation, temperature, pressure.	x	x				
LO	State that in general humidity is not controlled.	x	x				
LO	Explain that the following components constitute a pressurisation system: pneumatic system as the power source; outflow valve; outflow valve actuator; pressure controller; excessive differential pressure-relief valve; negative differential pressure-relief valve.	x	x				
LO	Explain that the following components constitute an air-conditioning system and describe their operating principles and function: air-cycle machine (pack, bootstrap system); pack-cooling fan; water separator; mixing valves; flow-control valves (outflow valve); isolation valves; ram-air valve; recirculation fans; filters for recirculated air; temperature sensors. Remark: The bootstrap system is the only air-conditioning system considered for Part-FCL aeroplane examinations.	x	x				
LO	Describe the use of hot trim air.	x	x				

LO	Define the following terms: cabin altitude; cabin vertical speed; differential pressure; ground pressurisation.	x	x				
LO	Describe the operating principle of a pressurisation system.	x	x				
LO	Describe the emergency operation by manual setting of the outflow valve position.	x	x				
LO	Describe the working principle of an electronic cabin-pressure controller.	x	x				
LO	State how the maximum operating altitude is determined.	x	x				
LO	State: the maximum allowed value of cabin altitude; a typical value of maximum differential pressure for large transport aeroplanes (8 to 9 psi); the relation between cabin altitude, the maximum differential pressure and maximum aeroplane operating altitude.	x	x				
LO	Identify the aural warning when cabin altitude exceeds 10 000 ft.	x	x				
LO	List the indications of the pressurisation system.	x	x				
021 07 00 00	**ANTI-ICING AND DE-ICING SYSTEMS**						
021 07 01 00	**Types, design, operation, indications and warnings, operational limitations**						
LO	Explain the concepts of de-icing and anti-icing.	x	x	x	x	x	
LO	Name the components of an aircraft which can be protected from ice accretion.	x	x	x	x	x	
LO	State that on some aeroplanes the tail does not have an ice-protection system.	x	x				
LO	State the different types of anti-icing/de-icing systems (hot air, electrical, fluid).	x	x	x	x	x	
LO	Describe the operating principle of these systems.	x	x	x	x	x	
LO	Describe the operating principle of the inflatable boot de-icing system.	x	x				

021 07 02 00	**Ice-warning systems: types, operation, and indications**						
LO	Describe the different operating principles of the following ice detectors: mechanical systems using air pressure; electromechanical systems using resonance frequencies.	x	x				
LO	Describe the principle of operation of ice-warning systems.	x	x				
021 07 03 00	**Helicopter blade-heating systems**						
LO	Explain the limitations on blade heating and the fact that on some helicopters the heating does not heat all the main rotor blades at the same time.			x	x	x	
021 08 00 00	**FUEL SYSTEM**						
021 08 01 00	**Piston engine**						
021 08 01 01	**Fuel: types, characteristics, limitations**						
LO	State the types of fuel used by piston engine (diesel, AVGAS, MOGAS) and their associated limitations.	x	x	x	x	x	
LO	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.	x	x	x	x	x	
021 08 01 02	**Design, operation, system components, indications**						
LO	State the tasks of the fuel system.	x	x	x	x	x	

LO	Name the following main components of a fuel system, and state their location and their function. lines; boost pump; pressure valves; filter, strainer; tanks (wing, tip, fuselage); vent system; sump; drain; fuel-quantity sensor; temperature sensor.	x	x	x	x	x	
LO	Describe a gravity fuel feed system and a pressure feed fuel system.	x	x	x	x	x	
LO	Describe the construction of the different types of fuel tanks and state their advantages and disadvantages: drum tank, bladder tank, integral tank.	x	x	x	x	x	
LO	Explain the function of cross-feed.	x	x	x	x	x	
LO	Define the term 'unusable fuel'.	x	x	x	x	x	
LO	List the following parameters that are monitored for the fuel system: fuel quantity (low-level warning); fuel temperature.	x	x	x	x	x	
021 08 02 00	**Turbine engine**						
021 08 02 01	**Fuel: types, characteristics, limitations**						
LO	State the types of fuel used by gas turbine engine (JET-A, JET-A1, JET-B).	x	x	x	x	x	
LO	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.	x	x	x	x	x	
LO	State the existence of additives for freezing.	x	x	x	x	x	

021 08 02 02	**Design, operation, system components, indications**						
LO	State the tasks of the fuel system.	x	x	x	x	x	
LO	Name the main components of a fuel system, and state their location and their function: lines; centrifugal boost pump; pressure valves; fuel shut-off valve; filter, strainer; tanks (wing, tip, fuselage, tail); bafflers; sump; vent system; drain; fuel-quantity sensor; temperature sensor; refuelling/defuelling system; fuel dump/jettison system.	x	x	x	x	x	
LO	Interpret the fuel-system schematic appended to these LOs.	x	x				
LO	Explain the limitations in the event of loss of booster pump fuel pressure.	x	x	x	x	x	
LO	Describe the construction of the different types of fuel tanks and state their advantages and disadvantages: drum tank, bladder tank, integral tank.	x	x	x	x	x	
LO	Explain the function of cross-feed and transfer.	x	x	x	x	x	
LO	Define the term ‘unusable fuel’.	x	x	x	x	x	
LO	Describe the use and purpose of drip sticks (manual magnetic indicators).	x	x	x	x	x	
LO	Explain the considerations for fitting a fuel dump/jettison system.	x	x	x	x	x	

LO	List the following parameters that are monitored for the fuel system: fuel quantity (low-level warning); fuel temperature.	x	x	x	x	x	
021 09 00 00	**ELECTRICS**						
021 09 01 00	**General, definitions, basic applications: circuit breakers, logic circuits.**						
021 09 01 01	**Static electricity**						
LO	Explain static electricity.	x	x	x	x	x	
LO	Describe a static discharger and explain its purpose.	x	x	x	x	x	
LO	Explain why an aircraft must first be grounded before refuelling/defuelling.	x	x	x	x	x	
LO	Explain the reason for electrical bonding.	x	x	x	x	x	
021 09 01 02	**Direct current**						
LO	State that a current can only flow in a closed circuit.	x	x	x	x	x	
LO	Explain the basic principles of conductivity and give examples of conductors, semiconductors and insulators.	x	x	x	x	x	
LO	State the operating principle of mechanical (toggle, rocker, push and pull), thermo, time and proximity switches.	x	x	x	x	x	
LO	Define 'voltage', 'current and resistance', and state their unit of measurement.	x	x	x	x	x	
LO	Explain Ohm's law in qualitative terms.	x	x	x	x	x	
LO	Explain the effect on total resistance when resistors are connected in series or in parallel.	x	x	x	x	x	
LO	State that resistances can have a positive or a negative temperature coefficient (PTC/ NTC) and state their use.	x	x	x	x	x	
LO	Define 'electrical work and power' in qualitative terms and state the unit of measurement.	x	x	x	x	x	
LO	Define the term 'electrical field' and 'magnetic field' in qualitative terms and explain the difference with the aid of the Lorentz force (Electromotive Force (EMF)).	x	x	x	x	x	
LO	Explain the term 'capacitance' and explain the use of a capacitor as a storage device.	x	x	x	x	x	

021 09 01 03	**Alternating current**						
LO	Explain the term 'alternating current' (AC).	x	x	x	x	x	
LO	Define the term 'phase'.	x	x	x	x	x	
LO	Explain the principle of single-phase and three-phase AC and state its use in the aircraft.	x	x	x	x	x	
LO	Define 'frequency' in qualitative terms and state the unit of measurement.	x	x	x	x	x	
LO	Explain the use of a particular frequency in aircraft.	x	x	x	x	x	
LO	Define 'phase shift' in qualitative terms.	x	x	x	x	x	
021 09 01 04	**Resistors, capacitors, inductance coil**						
LO	Describe the relation between voltage and current of an ohmic resistor in an AC/DC circuit.	x	x	x	x	x	
LO	Describe the relation between voltage and current of a capacitor in an AC/DC circuit.	x	x	x	x	x	
LO	Describe the relation between voltage and current of a coil in an AC/DC circuit.	x	x	x	x	x	
021 09 01 05	**Permanent magnets**						
LO	Explain the term 'magnetic flux'.	x	x	x	x	x	
LO	State the pattern and direction of the magnetic flux outside the magnetic poles and inside the magnet.	x	x	x	x	x	
021 09 01 06	**Electromagnetism**						
LO	State that an electrical current produces a magnetic field and define the direction of that field.	x	x	x	x	x	
LO	Describe how the strength of the magnetic field changes if supported by a ferromagnetic core.	x	x	x	x	x	
LO	Explain the purpose and the working principle of a solenoid.	x	x	x	x	x	
LO	Explain the purpose and the working principle of a relay.	x	x	x	x	x	
LO	Explain the principle of electromagnetic induction.	x	x	x	x	x	
LO	List the parameters affecting the inductance of a coil.	x	x	x	x	x	
LO	List the parameters affecting the induced voltage in a coil.	x	x	x	x	x	

021 09 01 07	**Circuit breakers**					
LO	Explain the operating principle of a fuse and a circuit breaker.	x	x	x	x	x
LO	Explain how a fuse is rated.	x	x	x	x	x
LO	State the difference between a 'trip-free' and 'non-trip-free' circuit breaker.	x	x	x	x	x
LO	List the following different types of circuit breakers: thermal circuit breaker; magnetic circuit breaker.	x	x	x	x	x
021 09 01 08	**Semiconductors and logic circuits**					
LO	State the differences between semiconductor materials and conductors and explain how the conductivity of semiconductors can be altered.	x	x	x	x	x
LO	State the principal function of diodes, such as rectification and voltage limiting.	x	x	x	x	x
LO	State the principal function of transistors, such as switching and amplification.	x	x	x	x	x
LO	Explain the following five basic functions: AND, OR, NOT, NOR and NAND.	x	x	x	x	x
LO	Describe their associated symbols.	x	x	x	x	x
LO	Interpret logic diagrams using a combination of these functions.	x	x	x	x	x
021 09 02 00	**Batteries**					
021 09 02 01	**Types, characteristics and limitations**					
LO	State the function of an aircraft battery.					
LO	Name the types of rechargeable batteries used in aircraft.	x	x	x	x	x
LO	Compare lead-acid and nickel-cadmium (Ni-Cd) batteries with respect to weight, voltage, load behaviour, self-discharge, charging characteristics, thermal runaway and storage life.	x	x	x	x	x
LO	Explain the term 'cell voltage'.	x	x	x	x	x
LO	State that a battery is composed of several cells.	x	x	x	x	x
LO	Explain the difference between battery voltage and charging voltage.	x	x	x	x	x

LO	State the charging voltage that corresponds with different battery voltages.	x	x	x	x	x	
LO	Define the term 'capacity of batteries' and state the unit of measurement used.	x	x	x	x	x	
LO	State the effect of temperature on battery capacity.	x	x	x	x	x	
LO	State the relationship between voltage and capacity when batteries are connected in series or in parallel.	x	x	x	x	x	
LO	State that in the case of loss of all generated power (battery power only) the remaining electrical power is time-limited.	x	x	x	x	x	
021 09 03 00	**Generation**						
	Remark: For standardisation purposes, the following standard expressions are used: DC generator: produces DC output; DC alternator: produces internal AC, rectified by integrated rectifying unit, the output is DC; AC generator: produces AC output; starter generator: integrated combination of a DC generator with DC output and a starter motor using battery DC; permanent magnet alternator/ generator: produces AC output without field excitation using a permanent magnet.	x	x	x	x	x	
021 09 03 01	**DC generation**						
LO	Describe the working principle of a simple DC alternator and name its main components.	x	x	x	x	x	
LO	State in qualitative terms how voltage depends on the number of windings, field strength, RPM and load.	x	x	x	x	x	
LO	List the differences between a DC generator and a DC alternator with regard to voltage response at low RPM, power–weight ratio, and brush sparking.	x	x	x	x	x	
LO	Explain the principle of voltage control.	x	x	x	x	x	
LO	Explain why reverse current flow from the battery to the generator must be prevented.	x	x	x	x	x	
LO	Describe the operating principle of a starter generator and state its purpose.	x	x	x	x	x	

021 09 03 02	**AC generation**						
LO	Describe the components of a three-phase AC generator and the operating principle.	x	x	x	x	x	
LO	State that the generator field current is used to control voltage.	x	x	x	x	x	
LO	State in qualitative terms the relation between frequency, number of pole pairs and RPM of a three-phase generator.	x	x	x	x	x	
LO	Explain the term 'wild-frequency generator'.	x	x	x	x	x	
LO	Describe how a three-phase AC generator can be connected to the electrical system.	x	x	x	x	x	
LO	Describe the purpose and the working principle of a permanent magnet alternator/generator.	x	x	x	x	x	
LO	List the following different power sources that can be used for an aeroplane to drive an AC generator: engine, APU, RAT, hydraulic.	x	x				
LO	List the following different power sources that can be used for a helicopter to drive an AC generator: engine, APU, gearbox.			x	x	x	
021 09 03 03	**Constant Speed Drive (CSD) and Integrated Drive Generator (IDG) systems.**						
LO	Describe the function and the working principle of a CSD.	x	x				
LO	Explain the parameters of a CSD that are monitored.	x	x				
LO	Describe the function and the working principle of an IDG.	x	x				
LO	Explain the consequences of a mechanical disconnection during flight for a CSD and an IDG.	x	x				
021 09 03 04	**Transformers, transformer rectifier units, static inverters**						

LO	State the function of a transformer and its operating principle.	x	x	x	x	x	
LO	State the function of a Transformer Rectifier Unit (TRU), its operating principle and the voltage output.	x	x	x	x	x	
LO	State the function of static inverters, their operating principle and the voltage output.	x	x	x	x	x	
021 09 04 00	**Distribution**						
021 09 04 01	**General**						
LO	Explain the function of a bus (bus bar).	x	x	x	x	x	
LO	Describe the function of the following buses: main bus, tie bus, essential bus, emergency bus, ground bus, battery bus, hot (battery) bus.	x	x	x	x	x	
LO	State that the aircraft structure can be used as a part of the electrical circuit (common earth) and explain the implications for electrical bonding.	x	x	x	x	x	
LO	Explain the function of external power.	x	x	x	x	x	
LO	State that a priority sequence exists between the different sources of electrical power on ground and in flight.	x	x	x	x	x	
LO	Introduce the term 'load sharing'.	x	x	x	x	x	
LO	Explain that load sharing is always achieved during parallel operations.	x	x	x	x	x	
LO	Introduce the term 'load shedding'.	x	x	x	x	x	
LO	Explain that an AC load can be shed in case of generator overload.	x	x	x	x	x	
LO	Interpret an electrical-system schematic (appended to these LOs). Remark: The system described is a split system.	x	x	x	x	x	
021 09 04 02	**DC distribution**						

LO	Describe a simple DC electrical system of a single-engine aircraft.	x	x	x	x	x	
LO	Describe a DC electrical system of a multi-engine aircraft (CS-23/CS-27) including the distribution consequences of loss of generator(s) or bus failure.	x	x	x	x	x	
LO	Describe the DC part of an electrical system of a transport aircraft (CS-25/CS-29) including the distribution consequences of loss of DC supply or bus failure.	x	x	x	x	x	
LO	Give examples of DC consumers.	x	x	x	x	x	
021 09 04 03	**AC distribution**						
LO	Describe the AC electrical system of a transport aircraft for split and parallel operation.	x	x	x	x	x	
LO	Describe the distribution consequences of: APU electrical supply and external power priority switching; loss of (all) generator(s); bus failure.	x	x	x	x	x	
LO	Give examples of AC consumers.	x	x	x	x	x	
LO	Explain the conditions to be met for paralleling AC generators.	x	x	x	x	x	
LO	Explain the terms 'real and reactive loads'.	x	x	x	x	x	
LO	State that real/reactive loads are compensated in the case of paralleled AC generators.	x	x	x	x	x	
021 09 04 04	**Electrical load management and monitoring systems: automatic generators and bus switching during normal and failure operation, indications and warnings**						
LO	Give examples of system control, monitoring and annunciators.	x	x	x	x	x	
LO	Describe, for normal (on ground/in flight) and degraded modes of operation, the following functions of an electrical load management system: distribution, monitoring, protection (overloading, over/under voltage, incorrect frequency).	x	x	x	x	x	

LO	State which parameters are used to monitor an electrical system for parallel and split system operation.	x	x	x	x	x	
LO	Describe how batteries are monitored.	x	x	x	x	x	
LO	State that Ni-Cd batteries are monitored to avoid damage resulting from excessive temperature increase (thermal runaway).	x	x	x	x	x	
LO	Interpret various different ammeter indications of an ammeter which monitors the charge current of the battery.	x	x	x	x	x	
021 09 05 00	**Electrical motors**						
021 09 05 01	**General**						
LO	State that the purpose of an electric motor is to convert electrical energy into mechanical energy.	x	x	x	x	x	
021 09 05 02	**Operating principle**						
LO	Explain the operating principle of an electric motor as being an electrical current carrying conductor inside a magnetic field that experiences a Lorentz/electromotive (EMF) force.	x	x	x	x	x	
LO	State that electrical motors can be AC or DC type.	x	x	x	x	x	
021 09 05 03	**Components**						
LO	Name the following components of an electric motor and explain their function: rotor (rotating part of an electric motor); stator (stationary part of an electric motor).	x	x	x	x	x	
021 10 00 00	**PISTON ENGINES**						
	Remark: This topic includes diesel engines and petrol engines.						
021 10 01 00	**General**						
021 10 01 01	**Types of internal-combustion engines: basic principles, definitions**						

LO	Define the following terms and expressions: RPM; torque; Manifold Absolute Pressure (MAP); power output; specific fuel consumption; mechanical efficiency, thermal efficiency, volumetric efficiency; compression ratio, clearance volume, swept (displaced) volume, total volume.	x	x	x	x	x	
LO	Describe the influence of compression ratio on thermal efficiency.	x	x	x	x	x	
021 10 01 02	**Engine: design, operation, components and materials**						
LO	Describe the following main engine components and state their function. crankcase, crankshaft, connecting rod, piston, piston pin, piston rings, cylinder, cylinder head, valves, valve springs, push rod, camshaft, rocker arm, camshaft gear, bearings.	x	x	x	x	x	

LO	State the materials used for the following engine components: crankcase, crankshaft, connecting rod, piston, piston pin, cylinder, cylinder head, valves, camshaft.	x	x	x	x	x	
LO	Name and identify the various types of engine design with regard to cylinder arrangement, such as: horizontal opposed, in line, radial, and working cycle (four stroke: petrol and diesel).	x	x	x	x	x	
LO	Describe the gas-state changes, the valve positions and the ignition timing during the four strokes of the theoretical piston-engine cycle.	x	x	x	x	x	
LO	Explain the main differences between the theoretical (Otto cycle) and the practical four-stroke piston-engine cycles.	x	x	x	x	x	
LO	Describe the differences between petrol engines and diesel engines with respect to: means of ignition; maximum compression ratio; air or mixture supply to the cylinder; specific power output (kW/kg); thermal efficiency; pollution from the exhaust.	x	x	x	x	x	
021 10 02 00	**Fuel**						
021 10 02 01	**Types, grades, characteristics, limitations**						

LO	Name the type of fuel used for petrol engines including its colour (AVGAS).	x	x	x	x	x	
LO	Name the types of fuel used for diesel engines (kerosene or diesel).	x	x	x	x	x	
LO	Define the term 'octane rating'.	x	x	x	x	x	
LO	Describe the combustion process in a piston-engine cylinder for both petrol and diesel engines.	x	x	x	x	x	
LO	Define the term 'flame front velocity' and describe its variations depending on the fuel-air mixture for petrol engines.	x	x	x	x	x	
LO	Define the term 'detonation' and describe the causes and effects of detonation for both petrol and diesel engines.	x	x	x	x	x	
LO	Define the term 'pre-ignition' and describe the causes and effects of pre-ignition for both petrol and diesel engines.	x	x	x	x	x	
LO	Identify the conditions and power settings that promote detonation for petrol engines.	x	x	x	x	x	
LO	Describe how detonation in petrol engines is recognised.	x	x	x	x	x	
LO	Name the anti-detonation petrol fuel additive (tetraethyl lead).	x	x	x	x	x	
LO	Describe the method and occasions for checking the fuel for water content.	x	x	x	x	x	
LO	State the typical value of fuel density for aviation gasoline and diesel fuel.	x	x	x	x	x	
LO	Explain volatility, viscosity and vapour locking for petrol and diesel fuels.	x	x	x	x	x	
021 10 03 00	**Engine fuel pumps**						
LO	Describe the need for a separate engine-driven fuel pump.	x	x	x	x	x	
LO	List the different types of engine-driven fuel pumps: gear type, vane type.	x	x	x	x	X	
021 10 04 00	**Carburettor/injection system**						
021 10 04 01	**Carburettor: design, operation, degraded modes of operation, indications and warnings**						
LO	State the purpose of a carburettor.	x	x	x	x	x	

LO	Describe the operating principle of the simple float chamber carburettor.	x	x	x	x	x	
LO	Describe the method of achieving reliable idle operation.	x	x	x	x	x	
LO	Describe the methods of obtaining mixture control over the whole operating engine power setting range (compensation jet, diffuser).	x	x	x	x	x	
LO	Describe the methods of obtaining mixture control over the whole operating altitude range.	x	x	x	x	x	
LO	Explain the purpose and the operating principle of an accelerator pump.	x	x	x	x	x	
LO	Explain the purpose of power enrichment.	x	x	x	x	x	
LO	Describe the function of the carburettor heat system.	x	x	x	x	x	
LO	Explain the effect of carburettor heat on mixture ratio and power output.	x	x	x	x	x	
LO	Explain the purpose and the operating principle of a primer pump.	x	x	x	x	x	
LO	Discuss other methods for priming an engine (acceleration pumps).	x	x	x	x	x	
LO	Explain the danger of carburettor fire, including corrective measures.	x	x	x	x	x	
021 10 04 02	**Injection: design, operation, degraded modes of operation, indications and warnings**						
LO	Describe the low pressure, continuous flow type, fuel injection system used on light aircraft piston petrol engines with the aid of a schematic diagram.	x	x	x	x	x	
LO	Explain the advantages of an injection system compared with a carburettor system.	x	x	x	x	x	
LO	Explain the requirement for two different pumps in the fuel injection system and describe their operation.	x	x	x	x	x	
LO	Describe the task and explain the operating principle of fuel and mixture control valves in the injection system for petrol engines.	x	x	x	x	x	
LO	Describe the task and explain the operating principle of the fuel manifold valve, the discharge nozzles and the fuel-flow meter in the fuel injection system for petrol engines.	x	x	x	x	x	

LO	Describe the injection system of a diesel engine and explain the function of the following components: high-pressure fuel injection pump; common-rail principle; fuel lines; fuel injectors.	x	x	x	x	x	
021 10 04 03	**Icing**						
LO	Describe the causes and effects of carburettor icing and the action to be taken if carburettor icing is suspected.	x	x	x	x	x	
LO	Name the meteorological conditions under which carburettor icing may occur.	x	x	x	x	x	
LO	Describe the indications of the presence of carburettor icing with both a fixed pitch and a constant speed propeller.	x	x				
LO	Describe the indications of the presence of carburettor icing with a helicopter.			x	x	x	
LO	Describe the indications that will occur upon selection of carburettor heat depending on whether ice is present or not.	x	x	x	x	x	
LO	Explain the reason for the use of alternate air on fuel injection systems and describe its operating principle.	x	x	x	x	x	
LO	State the meteorological conditions under which induction-system icing may occur.	x	x	x	x	x	
021 10 05 00	**Cooling systems**						
021 10 05 01	**Design, operation, indications and warnings**						
LO	Specify the reasons for cooling a piston engine.	x	x	x	x	x	
LO	Describe the design features to enhance cylinder air cooling for aeroplanes.	x	x				
LO	Describe the design features to enhance cylinder air cooling for helicopters (e.g. engine-driven impeller and scroll assembly, baffles).			x	x	x	
LO	Compare the advantages of liquid and air-cooling systems.	x	x	x	x	x	
LO	Identify the cylinder head temperature indication to monitor engine cooling.	x	x	x	x	x	

LO	Describe the function and the operation of cowl flaps.	x	x				
021 10 06 00	**Lubrication systems**						
021 10 06 01	**Lubricants: characteristics, limitations**						
LO	Describe the term 'viscosity' including the effect of temperature.	x	x	x	x	x	
LO	Describe the viscosity grade numbering system used in aviation.	x	x	x	x	x	
021 10 06 02	**Design, operation, indications and warnings**						
LO	State the functions of a piston-engine lubrication system.	x	x	x	x	x	
LO	Describe the working principle of a dry-sump lubrication system and describe the functions of the following components: oil tank (reservoir) and its internal components: hot well, de-aerator, vent, expansion space; check valve (non-return valve); pressure pump and pressure-relief valve; scavenge pump; filters (suction, pressure and scavenge); oil cooler; oil cooler bypass valve (anti-surge and thermostatic); pressure and temperature sensors; lines.	x	x	x	x	x	
LO	Describe a wet-sump lubrication system.	x	x	x	x	x	
LO	State the differences between a wet and a dry-sump lubrication system.	x	x	x	x	x	
LO	State the advantages/disadvantages of each system.	x	x	x	x	x	
LO	List the following factors that influence oil consumption: oil grade, cylinder and piston wear, condition of piston rings.	x	x	x	x	x	

LO	Describe the interaction between oil pressure, oil temperature and oil quantity.	x	x	x	x	x	
021 10 07 00	**Ignition circuits**						
021 10 07 01	**Design, operation**						
LO	Describe the working principle of a magneto-ignition system and the functions of the following components: magneto, contact-breaker points, capacitor (condenser), coils or windings, ignition switches, distributor, spark plug, high-tension (HT) cable.	x	x	x	x	x	
LO	State why piston engines are equipped with two electrically independent ignition systems.	x	x	x	x	x	
LO	State the function and operating principle of the following methods of spark augmentation: starter vibrator (booster coil), impulse-start coupling.	x	x				
LO	State the function and operating principle of the following methods of spark augmentation: starter vibrator (booster coil), both magnetos live.			x	x	x	
LO	Explain the function of the magneto check.	x	x	x	x	x	
LO	State the reasons for using the correct temperature grade for a spark plug.	x	x	x	x	x	
LO	Explain the function of ignition timing advance or retard.	x	x	x	x	x	
LO	Explain how combustion is initiated in diesel engines.	x	x	x	x	x	
021 10 08 00	**Mixture**						
021 10 08 01	**Definition, characteristic mixtures, control instruments, associated control levers, indications**						

LO	Define the following terms: mixture, chemically correct ratio (stoichiometric), best power ratio, lean (weak) mixture (lean or rich side of the EGT top), rich mixture.	x	x	x	x	x	
LO	State the typical fuel-to-air ratio values or range of values for the above mixtures.	x	x	x	x	x	
LO	Describe the advantages and disadvantages of weak and rich mixtures.	x	x	x	x	x	
LO	Describe the relation between engine-specific fuel consumption and mixture ratio.	x	x	x	x	x	
LO	Describe the use of the exhaust gas temperature as an aid to mixture-setting.	x	x	x	x	x	
LO	Explain the relation between mixture ratio, cylinder head temperature, detonation and pre-ignition.	x	x	x	x	x	
LO	Explain the absence of mixture control in diesel engines.	x	x	x	x	x	
021 10 09 00	**Aeroplane: propellers**						
021 10 09 01	**Definitions, general**						
	Remark: Definitions and aerodynamic concepts are detailed in subject 081, topic 07 (Propellers) but need to be appreciated for this subject as well.	x	x				
021 10 09 02	**Constant-speed propeller: design, operation, system components**						
LO	Describe the operating principle of a constant-speed propeller system under normal flight operations with the aid of a schematic.	x	x				
LO	Explain the need for a Manifold Absolute Pressure (MAP) indicator to control the power setting with a constant-speed propeller.	x	x				
LO	State the purpose of a torque-meter.	x	x				
LO	State the purpose and describe the operation of a low-pitch stop (centrifugal latch).	x	x				
LO	Describe the operating principle of a single-acting and a double-acting variable pitch propeller for single and multi-engine aeroplanes.	x	x				

LO	Describe the function and the basic operating principle of synchronising and synchro-phasing systems.	x	x				
LO	Explain the purpose and the basic operating principle of an auto-feathering system including un-feathering.	x	x				
021 10 09 03	**Reduction gearing: design**						
LO	State the purpose of reduction gearing.	x	x				
LO	Explain the principles of design for reduction gearing.	x	x				
021 10 09 04	**Propeller handling: associated control levers, degraded modes of operation, indications and warnings**						
LO	Describe the checks to be carried out on a constant-speed propeller system after engine start.	x	x				
LO	Describe the operation of a constant-speed propeller system during flight at different true airspeeds and RPM including an overspeeding propeller.	x	x				
LO	Describe the operating principle of a variable pitch propeller when feathering and unfeathering, including the operation of cockpit controls.	x	x				
LO	Describe the operating principle of a variable pitch propeller when reverse pitch is selected, including the operation of cockpit controls.	x	x				
LO	Describe the operation of the propeller levers during different phases of flight.	x	x				
021 10 10 00	**Performance and engine handling**						
021 10 10 01	**Performance**						
LO	Engine performance: define ‘pressure altitude’ and ‘density altitude’.	x	x	x	x	x	
LO	Describe the effect on power output of a petrol and diesel engine taking into consideration the following parameters: ambient pressure, exhaust back pressure; temperature; density altitude; humidity.	x	x	x	x	x	

LO	Explain the term ‘normally aspirated engine’.	x	x	x	x	x	
LO	Power-augmentation devices: explain the requirement for power augmentation (turbocharging) of a piston engine.	x	x	x	x	x	
LO	Describe the function and the principle of operation of the following main components of a turbocharger: turbine, compressor, waste gate, waste-gate actuator, absolute-pressure controller, density controller, differential-pressure controller.	x	x	x	x	x	
LO	Explain the difference between an altitude-boosted turbocharger and a ground-boosted turbocharger.	x	x	x	x	x	
LO	Explain turbo lag.	x	x	x	x	x	
LO	Define the term ‘critical altitude’.	x	x	x	x	x	
LO	Explain the function of an intercooler.	x	x	x	x	x	
LO	Define the terms ‘full-throttle height’ and ‘rated altitude’.	x	x	x	x	x	
021 10 10 02	**Engine handling**						
LO	State the correct procedures for setting the engine controls when increasing or decreasing power.	x	x	x	x	x	
LO	Define the following terms: take-off power; maximum continuous power.	x	x	x	x	x	
LO	Describe the term ‘hydraulicing’ and the precautions to be taken prior to engine start.	x	x	x	x	x	
LO	Describe the start problems associated with extreme cold weather.	x	x	x	x	x	
LO	FADEC for a piston engine: To be introduced at a later date.	x	x	x	x	x	
021 11 00 00	**TURBINE ENGINES**						
021 11 01 00	**Basic principles**						

021 11 01 01	**Basic generation of thrust and the thrust formula**						
LO	Describe how thrust is produced by a basic gas turbine engine.	x	x				
LO	Describe the simple form of the thrust formula for a basic, straight turbojet and perform simple calculations (including pressure thrust).	x	x				
LO	State that thrust can be considered to remain approximately constant over the whole aeroplane subsonic speed range.	x	x				
021 11 01 02	**Design, types of turbine engines, components**						
LO	List the main components of a basic gas turbine engine. inlet, compressor, combustion chamber, turbine, outlet.	x	x	x	x	x	
LO	Describe the system of station numbering in a gas turbine engine.	x	x	x	x	x	
LO	Describe the variation of static pressure, temperature and axial velocity in a gas turbine engine under normal operating conditions and with the aid of a working cycle diagram.	x	x	x	x	x	
LO	Describe the differences between absolute, circumferential (tangential) and axial velocity.	x	x	x	x	x	
LO	List the different types of gas turbine engines: straight jet, turbo fan, turbo prop.	x	x				
LO	State that a gas turbine engine can have one or more spools.	x	x	x	x	x	
LO	Describe how thrust is produced by turbojet and turbofan engines.	x	x				
LO	Describe how power is produced by turboprop engines.	x	x				
LO	Describe the term 'equivalent horsepower' (= thrust horsepower + shaft horsepower).	x	x				

LO	Explain the principle of a free turbine or free-power turbine.	x	x	x	x	x	
LO	Define the term 'bypass ratio' and perform simple calculations to determine bypass ratio.	x	x				
LO	Define the terms 'propulsive power', 'propulsive efficiency', 'thermal efficiency' and 'total efficiency'.	x	x				
LO	Describe the influence of compressor-pressure ratio on thermal efficiency.	x	x	x	x	x	
LO	Explain the variations of propulsive efficiency with forward speed for turbojet, turbofan and turboprop engines.	x	x				
LO	Define the term 'specific fuel consumption' for turbojets and turboprops.	x	x				
021 11 01 03	**Coupled turbine engine: design, operation, components and materials**						
LO	Name the main assembly parts of a coupled turbine engine and explain the operation of the engine.			x	x	x	
LO	Explain the limitations of the materials used with regard to maximum turbine temperature, engine and drive train torque limits.			x	x	x	
LO	Describe the possible effects on engine components when limits are exceeded.			x	x	x	
LO	Explain that when engine limits are exceeded, this event must be reported.			x	x	x	
021 11 01 04	**Free turbine engine: design, components and materials**						
LO	Describe the design methods to keep the engine's size small for installation in helicopters.			x	x	x	
LO	List the main components of a free turbine engine.			x	x	x	
LO	Describe how the power is developed by a turboshaft/free turbine engine.			x	x	x	
LO	Explain how the exhaust gas temperature is used to monitor turbine stress.			x	x	x	
021 11 02 00	**Main-engine components**						
021 11 02 01	**Aeroplane: air intake**						
LO	State the functions of the engine air inlet/air intake.	x	x				

LO	Describe the geometry of a subsonic (pitot-type) air inlet.	x	x				
LO	Explain the gas-parameter changes in a subsonic air inlet at different flight speeds.	x	x				
LO	Describe the reasons for, and the dangers of, the following operational problems concerning the engine air inlet: airflow separation, inlet icing, inlet damage, Foreign Object Damage (FOD), heavy in-flight turbulence.	x	x				
021 11 02 02	Compressor and diffuser						
LO	State the purpose of the compressor.	x	x	x	x	x	
LO	Describe the working principle of a centrifugal and an axial flow compressor.	x	x	x	x	x	
LO	Name the following main components of a single stage and describe their function for a centrifugal compressor: impeller, diffuser.	x	x	x	x	x	
LO	Name the following main components of a single stage and describe their function for an axial compressor: rotor vanes, stator vanes.	x	x	x	x	x	
LO	Describe the gas-parameter changes in a compressor stage.	x	x	x	x	x	
LO	Define the term 'pressure ratio' and state a typical value for one stage of a centrifugal and an axial flow compressor and for the complete compressor.	x	x	x	x	x	
LO	State the advantages and disadvantages of increasing the number of stages in a centrifugal compressor.	x	x	x	x	x	
LO	Explain the difference in sensitivity for Foreign Object Damage (FOD) of a centrifugal compressor compared with an axial flow type.	x	x	x	x	x	

LO	Explain the convergent air annulus through an axial flow compressor.	x	x	x	x	x	
LO	Describe the reason for twisting the compressor blades.	x	x	x	x	x	
LO	State the tasks of inlet guide vanes (IGVs).	x	x	x	x	x	
LO	State the reason for the clicking noise whilst the compressor slowly rotates on the ground.	x	x	x	x	x	
LO	State the advantages of increasing the number of spools.	x	x	x	x	x	
LO	Explain the implications of tip losses and describe the design features to minimise the problem.	x	x	x	x	x	
LO	Explain the problems of blade bending and flapping and describe the design features to minimise the problem.	x	x	x	x	x	
LO	Explain the following terms: compressor stall, engine surge.	x	x	x	x	x	
LO	State the conditions that are possible causes of stall and surge.	x	x	x	x	x	
LO	Describe the indications of stall and surge.	x	x	x	x	x	
LO	Describe the design features used to minimise the occurrence of stall and surge.	x	x	x	x	x	
LO	Describe a compressor map (surge envelope) with RPM lines, stall limit, steady state line and acceleration line.	x	x	x	x	x	
LO	Describe the function of the diffuser.	x	x	x	x	x	
021 11 02 03	Combustion chamber						
LO	Define the purpose of the combustion chamber.	x	x	x	x	x	
LO	List the requirements for combustion.	x	x	x	x	x	
LO	Describe the working principle of a combustion chamber.	x	x	x	x	x	
LO	Explain the reason for reducing the airflow axial velocity at the combustion chamber inlet (snout).	x	x	x	x	x	
LO	State the function of the swirl vanes (swirler).	x	x	x	x	x	
LO	State the function of the drain valves.	x	x	x	x	x	
LO	Define the terms ‘primary airflow’ and ‘secondary airflow’ and explain their purpose.	x	x	x	x	x	

LO	Explain the following two mixture ratios: primary airflow to fuel, total airflow (within the combustion chamber) to fuel.	x	x	x	x	x	
LO	Describe the gas-parameter changes in the combustion chamber.	x	x	x	x	x	
LO	State a typical maximum value of the outlet temperature of the combustion chamber.	x	x	x	x	x	
LO	Describe the following types of combustion chamber and state the differences between them: can type; can-annular, cannular or tubo-annular; annular; reverse-flow annular.	x	x	x	x	x	
LO	Describe the principle of operation of a simplex and a duplex fuel spray nozzle (atomiser).	x	x	x	x	x	
021 11 02 04	Turbine						
LO	Explain the purpose of a turbine in different types of gas turbine engines.	x	x	x	x	x	
LO	Describe the principles of operation of impulse, reaction and impulse-reaction axial flow turbines.	x	x	x	x	x	
LO	Name the main components of a turbine stage and their function.	x	x	x	x	x	
LO	Describe the working principle of a turbine.	x	x	x	x	x	
LO	Describe the gas-parameter changes in a turbine stage.	x	x	x	x	x	
LO	Describe the function and the working principle of active clearance control.	x	x	x	x	x	
LO	Describe the implications of tip losses and the means to minimise them.	x	x	x	x	x	
LO	Explain why the available engine thrust is limited by the turbine inlet temperature.	x	x	x	x	x	
LO	Explain the divergent gas-flow annulus through an axial-flow turbine.	x	x	x	x	x	
LO	Describe turbine-blade convection, impingement and film cooling.	x	x	x	x	x	

LO	Explain the high mechanical-thermal stress in the turbine blades and wheels.	x	x	x	x	x	
LO	Explain the term ‘creep’.	x	x	x	x	x	
LO	Explain the consequences of creep on the turbine.	x	x	x	x	x	
LO	Explain the terms ‘low-cycle fatigue’ and ‘high-cycle fatigue’.	x	x	x	x	x	
021 11 02 05	**Aeroplane: exhaust**						
LO	Name the following main components of the exhaust unit and their function: jet pipe, propelling nozzle, exhaust cone.	x	x				
LO	Describe the working principle of the exhaust unit.	x	x				
LO	Describe the gas-parameter changes in the exhaust unit.	x	x				
LO	Define the term ‘choked exhaust nozzle’ (not applicable to turboprops).	x					
LO	Explain how jet exhaust noise can be reduced.	x	x				
021 11 02 06	**Helicopter: air intake**						
LO	Name and explain the main task of the engine air intake.			x	x	x	
LO	Describe the use of a convergent air-intake ducting on helicopters.			x	x	x	
LO	Describe the reasons for and the dangers of the following operational problems concerning engine air intake: airflow separations, intake icing, intake damage, foreign object damage, heavy in-flight turbulence.			x	x	x	
LO	Describe the conditions and circumstances during ground operations when foreign object damage is most likely to occur.			x	x	x	

LO	Describe and explain the principles of air intake filter systems that can be fitted to some helicopters for operations in icing and sand conditions.			x	x	x	
LO	Describe the function of the heated pads on some helicopter air intakes.			x	x	x	
021 11 02 07	**Helicopter: exhaust**						
LO	Name the following main components of the exhaust unit and their function. jet pipe, exhaust cone.			x	x	x	
LO	Describe the working principle of the exhaust unit.			x	x	x	
LO	Describe the gas-parameter changes in the exhaust unit.			x	x	x	
021 11 03 00	**Additional components and systems**						
021 11 03 01	**Engine fuel system**						
LO	Name the main components of the engine fuel system and state their function.	x	x	x	x	x	
LO	Name the two types of engine-driven high-pressure pumps, such as: gear-type, swash plate-type.	x	x	x	x	x	
LO	State the tasks of the fuel control unit.	x	x	x	x	x	
LO	List the possible input parameters to a fuel control unit to achieve a given thrust/ power setting.	x	x	x	x	x	
021 11 03 02	**Engine control system**						
LO	State the tasks of the engine control system.	x	x	x	x	x	

LO	List the following different types of engine control systems (refer to AMC to CS-E 50 Engine control system (1) Applicability) and state their respective engine control (output) parameters: hydro mechanical (Main Engine Control (MEC)); hydro mechanical with a limited authority electronic supervisor (Power Management System/Control (PMS/PMC)); single channel full-authority engine control with hydro-mechanical backup; dual channel full-authority electronic engine control system with no backup or any other combination (FADEC).	x	x	x	x	x	
LO	Describe a FADEC as a full-authority dual-channel system including functions such as an electronic engine control unit, wiring, sensors, variable vanes, active clearance control, bleed configuration, electrical signalling of TLA (see also AMC to CS-E-50), and an EGT protection function and engine overspeed.	x		x	x		
LO	Explain how redundancy is achieved by using more than one channel in a FADEC system.	x		x	x		
LO	State the consequences of a FADEC single input data failure.	x		x	x		
LO	State that all input and output data are checked by both channels.	x		x	x		
LO	State that a FADEC system uses its own sensors and that in some cases also data from aircraft systems is used.	x		x	x		
LO	State that a FADEC must have its own source of electrical power.	x		x	x		
021 11 03 03	**Engine lubrication**						
LO	State the tasks of an engine lubrication system.	x	x				

LO	Name the following main components of a lubrication system and state their function: oil tank and centrifugal breather, oil pumps (pressure and scavenge pumps), oil filters (including the bypass), oil sumps, chip detectors, coolers.	x	x				
LO	Explain that each spool is fitted with at least one ball bearing two or more roller bearings.	x	x				
LO	Explain the use of compressor air in oil-sealing systems (e.g. labyrinth seals).	x	x				
021 11 03 04	**Engine auxiliary gearbox**						
LO	State the tasks of the auxiliary gearbox.	x	x				
LO	Describe how the gearbox is driven and lubricated.	x	x				
021 11 03 05	**Engine ignition**						
LO	State the task of the ignition system.	x	x				
LO	Name the following main components of the ignition system and state their function. power sources, trembler mechanism (vibrator), transformer, diodes, capacitors, discharge gap (high-tension tube), igniters.	x	x				
LO	State why jet turbine engines are equipped with two electrically independent ignition systems.	x	x				
LO	Explain the different modes of operation of the ignition system.	x	x				
021 11 03 06	**Engine starter**						
LO	Name the main components of the starting system and state their function.	x	x				
LO	Explain the principle of a turbine engine start.	x	x				

LO	Describe the following two types of starters: electric, pneumatic.	x	x				
LO	Describe a typical start sequence (on ground/in flight) for a turbofan.	x	x				
LO	Define 'self-sustaining RPM'.	x	x				
021 11 03 07	**Reverse thrust**						
LO	Name the following main components of a reverse-thrust system and state their function: reverse-thrust select lever, power source (pneumatic or hydraulic), actuators, doors, annunciations.	x	x				
LO	Explain the principle of a reverse-thrust system.	x	x				
LO	Identify the advantages and disadvantages of using reverse thrust.	x	x				
LO	Describe and explain the following different types of thrust-reverser systems: hot-stream reverser, clamshell or bucket-door system, cold-stream reverser (only turbofan engines), blocker doors, cascade vanes.	x	x				
LO	Explain the implications of reversing the cold stream (fan reverser) only on a high bypass ratio engine.	x	x				
LO	Describe the protection features against inadvertent thrust-reverse deployment in flight as present on most transport aeroplanes.	x	x				
LO	Describe the controls and indications provided for the thrust-reverser system.	x	x				
021 11 03 08	**Helicopter specifics on design, operation and components for:** **Additional components and systems such as lubrication system, ignition circuit, starter, accessory gearbox**						

LO	State the task of the lubrication system.			x	x	x	
LO	List and describe the common helicopter lubrication systems.			x	x	x	
LO	Name the following main components of a helicopter lubrication system: reservoir; pump assembly; external oil filter; magnetic chip detectors, electronic chip detectors; thermostatic oil coolers; breather.			x	x	x	
LO	Identify and name the components of a helicopter lubrication system from a diagram.			x	x	x	
LO	Identify the indications used to monitor a lubrication system including warning systems.			x	x	x	
LO	Explain the differences and appropriate use of straight oil and compound oil, and describe the oil numbering system for aviation use.			x	x	x	
LO	Explain and describe the ignition circuit for engine start and engine relight facility when the selection is set for both automatic and manual functions.			x	x	x	
LO	Explain and describe the starter motor and the sequence of events when starting, and that for most helicopters the starter becomes the generator after the starting sequence is over.			x	x	x	
LO	Explain and describe why the engine drives the accessory gearbox.			x	x	x	
021 11 04 00	**Engine operation and monitoring**						
021 11 04 01	**General**						
LO	Explain the following aeroplane engine limitations: take-off, go-around, maximum continuous thrust/power, maximum climb thrust/power.	x	x				
LO	Explain spool-up time.	x	x	x	x	x	
LO	Explain the reason for the difference between ground and approach flight idle values (RPM).	x	x				

LO	State the parameters that can be used for setting and monitoring the thrust/power.	x	x	x	x	x	
LO	Describe the terms ‘alpha range’, ‘beta range’ and ‘reverse thrust’ as applied to a turboprop power lever.	x	x				
LO	Explain the dangers of inadvertent beta-range selection in flight for a turboprop.	x	x				
LO	Explain the purpose of engine trending.	x	x	x	x		
LO	Explain how the exhaust gas temperature is used to monitor turbine stress.	x	x	x	x		
LO	Describe the effect of engine acceleration and deceleration on the EGT.	x	x	x	x		
LO	Describe the possible effects on engine components when EGT limits are exceeded.	x	x	x	x		
LO	Explain why engine-limit exceedances must be reported.	x	x	x	x		
LO	Explain the limitations on the use of the thrust-reverser system at low forward speed.	x	x				
LO	Explain the term ‘engine seizure’.	x	x	x	x		
LO	State the possible causes of engine seizure and explain their preventative measures.	x	x	x	x		
LO	Explain the reason for the difference in the pressures of the fuel and oil in the heat exchanger.	x	x	x	x		
LO	Explain oil-filter clogging (blockage) and the implications for the lubrication system.	x	x	x	x		
LO	Give examples of monitoring instruments of an engine.	x	x	x	x		
021 11 04 02	**Starting malfunctions**						
LO	Describe the indications and the possible causes of the following aeroplane starting malfunctions: false (dry or wet) start, tailpipe fire (torching), hot start, abortive (hung) start, no N1 rotation, no FADEC indications.	x	x				

LO	Describe the indications and the possible causes of the following helicopter starting malfunctions: false (dry or wet) start, tailpipe fire (torching), hot start, abortive (hung) start, no N1 rotation, freewheel failure,			x	x	x	
LO	no FADEC indications.			x	x		
021 11 04 03	**Re-light envelope**						
LO	Explain the re-light envelope.	x	x				
021 11 05 00	**Performance aspects**						
021 11 05 01	**Thrust, performance aspects, and limitations**						
LO	Describe the variation of thrust and specific fuel consumption with altitude at constant TAS.	x	x				
LO	Describe the variation of thrust and specific fuel consumption with TAS at constant altitude.	x	x				
LO	Explain the term ‘flat-rated engine’ by describing the change of take-off thrust, turbine inlet temperature and engine RPM with OAT.	x	x				
LO	Define the term ‘Engine Pressure Ratio’ (EPR).	x	x				
LO	Explain the use of reduced (flexible) and derated thrust for take-off, and explain the advantages and disadvantages when compared with a full-rated take-off.	x	x				
LO	Describe the effects of use of bleed air on RPM, EGT, thrust and specific fuel consumption.	x	x				
021 11 05 02	**Helicopter engine ratings, engine performance and limitations, engine handling: torque, performance aspects, engine handling and limitations.**						
LO	Describe engine rating torque limits for take-off, transient and maximum continuous.			x	x	x	
LO	Describe turbine outlet temperature (TOT) limits for take-off.			x	x	x	
LO	Explain why TOT is a limiting factor for helicopter performance.			x	x	x	

LO	Describe and explain the relationship between maximum torque available and density altitude, which leads to decreasing torque available with the increase of density altitude.			x	x	x	
LO	Explain that hovering downwind on some helicopters will noticeably increase the engine TOT.			x	x	x	
LO	Explain the reason why the engine performance is less when aircraft accessories are switched on, i.e. anti-ice, heating, hoist, filters.			x	x	x	
LO	Describe the effects of use of bleed air on engine parameters.			x	x	x	
LO	Explain that on some helicopter exceeding the TOT limit may cause the main rotor to droop (slow down).			x	x	x	
021 11 06 00	**Auxiliary Power Unit (APU)**						
021 11 06 01	**Design, operation, functions, operational limitations**						
LO	State that an APU is a gas turbine engine and list its tasks.	x		x	x		
LO	State the difference between the two types of APU inlets.	x		x	x		
LO	Define ‘maximum operating and maximum starting altitude’.	x		x	x		
LO	Name the typical APU control and monitoring instruments.	x		x	x		
LO	Describe the APU’s automatic shutdown protection.	x		x	x		
021 12 00 00	**PROTECTION AND DETECTION SYSTEMS**						
021 12 01 00	**Smoke detection**						
021 12 01 01	**Types, design, operation, indications and warnings**						
LO	Explain the operating principle of the following types of smoke detection sensors: optical, ionising.	x	x				
LO	Give an example of warnings, indications and function tests.	x	x				
021 12 02 00	**Fire-protection systems**						

021 12 02 01	**Fire extinguishing (engine and cargo compartments)**						
LO	Explain the operating principle of a built-in fire-extinguishing system and describe its components.	x	x	x	x	x	
LO	State that two discharges must be provided for each engine (see CS 25.1195(c)).	x	x				
021 12 02 02	**Fire detection**						
LO	Explain the following principles involved in fire detection: resistance and capacitance, gas pressure.	x	x	x	x	x	
LO	Explain fire-detection applications such as: bimetallic, continuous loop, gaseous loop (gas-filled detectors).	x	x	x	x	x	
LO	Explain why generally double-loop systems are used.	x	x	x	x	x	
LO	Give an example of warnings, indications and function test of a fire-protection system.	x	x	x	x	x	
021 12 03 00	**Rain-protection system**						
LO	Explain the principle and method of operation of the following windshield rain-protecting systems for an aeroplane: wipers, liquids (rain repellent), coating.	x	x				
LO	Explain the principle and method of operation of wipers for a helicopter.			x	x	x	
021 13 00 00	**OXYGEN SYSTEMS**						
LO	Describe the basic operating principle of a cockpit oxygen system and describe the following different modes of operation: normal (diluter demand), 100 %, emergency.	x	x				

LO	Describe the operating principle and the purposes of the following two portable oxygen systems: smoke hood, portable bottle.	x	x				
LO	Describe the following two oxygen systems that can be used to supply oxygen to passengers: fixed system (chemical oxygen generator or gaseous); portable.	x	x				
LO	Describe the actuation methods (automatic and manual) and the functioning of a passenger oxygen mask.	x	x				
LO	Compare chemical oxygen generators to gaseous systems with respect to: capacity, flow regulation.	x	x				
LO	State the dangers of grease or oil related to the use of oxygen systems.	x	x				
021 14 00 00	**HELICOPTER: MISCELLANEOUS SYSTEMS**						
021 14 01 00	**Variable rotor speed**						
LO	Explain the system when pilots can 'beep' the NR an additional amount when manoeuvring, landing and taking off, normally at higher altitudes to obtain extra tail-rotor thrust, which makes manoeuvring more positive and safer.			x	x	x	
LO	Explain the system for 'beeping' the NR to its upper limit to enable safer take-off.			x	x	x	
021 14 02 00	**Active vibration suppression**						
LO	Explain and describe how the active vibration suppression system works through high-speed actuators and accelerometer inputs.			x	x	x	
021 14 03 00	**Night-vision goggles**						
LO	To be introduced at a later date.			x	x	x	
021 15 00 00	**HELICOPTER: ROTOR HEADS**						
021 15 01 00	**Main rotor**						
021 15 01 01	**Types**						

LO	Describe the following rotor-head systems: teetering, articulated, hingeless, bearingless.			x	x	x	
LO	Describe the following configuration of rotor systems and their advantages and disadvantages: tandem, coaxial, side by side.			x	x	x	
LO	Explain how flapping, dragging and feathering is achieved in each rotor-head system.			x	x	x	
021 15 01 02	**Structural components and materials, stresses, structural limitations**						
LO	Identify from a diagram the main structural components of the main types of rotor-head system.			x	x	x	
LO	List and describe the methods used on how to detect damage and cracks.			x	x	x	
LO	Explain and describe the structural limitations to respective rotor systems, including the dangers of negative G inputs to certain rotor-head systems.			x	x	x	
LO	Describe the various rotor-head lubrication methods.			x	x	x	
021 15 01 03	**Design and construction**						
LO	Describe the material technology used in rotor-head design, including construction using the following materials or mixture of materials: composites, fibreglass, alloys, elastomers.			x	x	x	
021 15 01 04	**Adjustment**						
LO	Describe and explain the methods of adjustment which are possible on various helicopter rotor-head assemblies.			x	x	x	
021 15 02 00	**Tail rotor**						

021 15 02 01	**Types**						
LO	Describe the following tail-rotor systems: delta 3 hinge; multi-bladed delta 3 effect; Fenestron or ducted fan tail rotor; No Tail Rotor (NOTAR) high-velocity air jet flows from adjustable nozzles (the Coandă effect).			x	x	x	
LO	Identify from a diagram the main structural components of the four main types of tail-rotor systems.			x	x	x	
LO	Explain and describe the methods to detect damage and cracks on the tail rotor and assembly.			x	x	x	
LO	Explain and describe the structural limitations to the respective tail-rotor systems and possible limitations regarding the turning rate of the helicopter.			x	x	x	
LO	Explain and describe the following methods that helicopter designers use to minimise tail-rotor drift and roll: reducing the couple arm (tail rotor on a pylon); offsetting the rotor mast; use of 'bias' in cyclic control mechanism.			x	x	x	
LO	Explain pitch-input mechanisms.			x	x	x	
LO	Explain the relationship between tail-rotor thrust and engine power.			x	x	x	
LO	Describe how the vertical fin on some helicopters reduces the power demand of the Fenestron.			x	x	x	
021 15 02 02	**Design and construction**						
LO	List and describe the various tail-rotor designs and construction methods used on current helicopters in service.			x	x	x	
021 15 02 03	**Adjustment**						
LO	Describe the rigging and adjustment of the tail-rotor system to obtain optimum position of the pilot's yaw pedals.			x	x	x	
021 16 00 00	**HELICOPTER: TRANSMISSION**						
021 16 01 00	**Main gearbox**						
021 16 01 01	**Different types, design, operation, limitations**						

LO	Describe the following main principles of helicopter transmission systems for single and twin-engine helicopters: drive for the main and tail rotor; accessory drive for the generator(s) alternator(s), hydraulic and oil pumps, oil cooler(s) and tachometers.			x	x	x	
LO	Describe the reason for limitations on multi-engine helicopter transmissions in various engine-out situations.			x	x	x	
LO	Describe how the passive vibration control works with gearbox mountings.			x	x	x	
021 16 02 00	**Rotor brake**						
LO	Describe the main function of the disc type of rotor brake.			x	x	x	
LO	Describe both hydraulic and cable operated rotor-brake systems.			x	x	x	
LO	Describe the different options for the location of the rotor brake.			x	x	x	
LO	List the following operational considerations for the use of rotor brakes: rotor speed at engagement of rotor brake; risk of blade sailing in windy conditions; risk of rotor-brake overheating and possible fire when brake is applied above the maximum limit, particularly when spilled hydraulic fluid is present; avoid stopping blades over jet-pipe exhaust with engine running; cockpit annunciation of rotor-brake operation.			x	x	x	
021 16 03 00	**Auxiliary systems**						
LO	Explain how the hoist/winch can be driven by an off-take from the auxiliary gearbox.			x	x	x	
LO	Explain how power for the air-conditioning system is taken from the auxiliary gearbox.			x	x	x	
021 16 04 00	**Driveshaft and associated installation**						
LO	Describe how power is transmitted from the engine to the main rotor gearbox.			x	x	x	
LO	Describe the material and construction of the driveshaft.			x	x	x	
LO	Explain the need for alignment between the engine and the main rotor gearbox.			x	x	x	

LO	Identify how temporary misalignment occurs between driving and driven components.			x	x	x	
LO	Explain the use of: flexible couplings; Thomas couplings; flexible disc packs; driveshaft support bearings and temperature measurement; subcritical and supercritical driveshafts.			x	x	x	
LO	Explain the relationship between the driveshaft speed and torque.			x	x	x	
LO	Describe the methods with which power is delivered to the tail rotor.			x	x	x	
LO	Describe and identify the construction and materials of tail rotor/Fenestron driveshafts.			x	x	x	
021 16 05 00	**Intermediate and tail gearbox**						
LO	Explain and describe the various arrangements when the drive changes direction and the need for an intermediate or tail gearbox.			x	x	x	
LO	Explain the lubrication requirements for intermediate and tail-rotor gearboxes and methods of checking levels.			x	x	x	
LO	Explain how on most helicopters the tail-rotor gearbox contains gearing, etc., for the tail-rotor pitch-change mechanism.			x	x	x	
021 16 06 00	**Clutches**						
LO	Explain the purpose of a clutch.			x	x	x	
	Describe and explain the operation of a: centrifugal clutch, actuated clutch.			x	x	x	
LO	List the typical components of the various clutches.			x	x	x	
LO	Identify the following methods by which clutch serviceability can be ascertained: brake-shoe dust; vibration; main-rotor run-down time; engine speed at time of main-rotor engagement; belt tensioning; start protection in a belt-drive clutch system.			x	x	x	
021 16 07 00	**Freewheels**						
LO	Explain the purpose of a freewheel.			x	x	x	

LO	Describe and explain the operation of a: cam and roller type freewheel, sprag-clutch type freewheel.			x	x	x	
LO	List the typical components of the various freewheels.			x	x	x	
LO	Identify the various locations of freewheels in power plant and transmission systems.			x	x	x	
LO	Explain the implications regarding the engagement and disengagement of the freewheel.			x	x	x	
021 17 00 00	**HELICOPTER: BLADES**						
021 17 01 00	**Main-rotor blade**						
021 17 01 01	**Design, construction**						
LO	Describe the different types of blade construction and the need for torsional stiffness.			x	x	x	
LO	Describe the principles of heating systems/pads on some blades for anti-icing/de-icing.			x	x	x	
021 17 01 02	**Structural components and materials**						
LO	List the materials used in the construction of main-rotor blades.			x	x	x	
LO	List the main structural components of a main-rotor blade and their function.			x	x	x	
021 17 01 03	**Stresses**						
LO	Describe main-rotor blade-loading on the ground and in flight.			x	x	x	
LO	Describe where the most common stress areas are on rotor blades.			x	x	x	
021 17 01 04	**Structural limitations**						
LO	Explain the structural limitations in terms of bending and rotor RPM.			x	x	x	
021 17 01 05	**Adjustment**						
LO	Explain the use of trim tabs.			x	x	x	
021 17 01 06	**Tip shape**						
LO	Describe the various blade-tip shapes used by different manufacturers and compare their advantages and disadvantages.			x	x	x	

LO	Describe how on some rotor-blade tips, static and dynamic balancing weights are attached to threaded rods and screwed into sockets in the leading edge spar and others in a support embedded into the blade tip.			x	x	x	
021 17 02 00	**Tail-rotor blade**						
021 17 02 01	**Design, construction**						
LO	Describe the most common design of tail-rotor blade construction, consisting of stainless steel shell reinforced by a honeycomb filler and stainless steel leading abrasive strip.			x	x	x	
LO	Explain that ballast weights are located at the inboard trailing edge and tip of blades, and that the weights used are determined when the blades are manufactured.			x	x	x	
LO	Describe how anti-icing/de-icing systems are designed into the blade construction of some helicopters.			x	x	x	
021 17 02 02	**Structural components and materials**						
LO	List the materials used in the construction of tail-rotor blades.			x	x	x	
LO	List the main structural components of a tail-rotor blade and their function.			x	x	x	
021 17 02 03	**Stresses**						
LO	Describe the tail-rotor blade-loading on the ground and in flight.			x	x	x	
021 17 02 04	**Structural limitations**						
LO	Describe the structural limitations of tail-rotor blades.			x	x	x	
LO	Describe the method of checking the strike indicators placed on the tip of some tail-rotor blades.			x	x	x	
021 17 02 05	**Adjustment**						
LO	Describe the adjustment of yaw pedals in the cockpit to obtain full control authority of the tail rotor.			x	x	x	

C. SUBJECT 022 — INSTRUMENTATION

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
020 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE**						
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**						
022 01 00 00	**SENSORS AND INSTRUMENTS**						
022 01 01 00	**Pressure gauge**						
LO	Define 'pressure', 'absolute pressure' and 'differential pressure'.	x	x	x	x	x	
LO	List the following units used for pressure: Pascal, bar, inches of mercury (in Hg), pounds per square inch (PSI).	x	x	x	x	x	
LO	State the relationship between the different units.	x	x	x	x	x	
LO	List and describe the following different types of sensors used according to the pressure to be measured: aneroid capsules, bellows, diaphragms, bourdon tube.	x	x	x	x	x	
LO	Solid-state sensors (to be introduced at a later date)	x	x	x	x	x	
LO	For each type of sensor identify applications such as: liquid-pressure measurement (fuel, oil, hydraulic); air-pressure measurement (bleed-air systems, air-conditioning systems); Manifold Absolute Pressure (MAP) gauge.	x	x	x	x	x	
LO	Pressure probes for Engine Pressure Ratio (EPR).	x	x				
LO	Give examples of display for each of the applications above.	x	x	x	x	x	
LO	Explain the need for remote-indicating systems.	x	x	x	x	x	

022 01 02 00	**Temperature sensing**						
LO	Explain temperature.	x	x	x	x	x	
LO	List the following units that can be used for temperature measurement: Kelvin, Celsius, Fahrenheit.	x	x	x	x	x	
LO	State the relationship between these different units.	x	x	x	x	x	
LO	Describe and explain the operating principles of the following types of sensors: expansion type (bimetallic strip), electrical type (resistance, thermocouple).	x	x	x	x	x	
LO	State the relationship for a thermocouple between the electromotive force and the temperature to be measured.	x	x	x	x	x	
LO	For each type, identify applications such as: gas-temperature measurement (ambient air, bleed-air systems, air-conditioning systems, air inlet, exhaust gas, gas turbine outlets); liquid-temperature measurement (fuel, oil, hydraulic).	x	x	x	x	x	
LO	Give examples of display for each of the applications above.	x	x	x	x	x	
022 01 03 00	**Fuel gauge**						
LO	State that the quantity of fuel can be measured by volume or mass.	x	x	x	x	x	
LO	List the following units used for fuel quantity when measured by mass: kilogramme; pound.	x	x	x	x	x	
LO	State the relationship between these different units.	x	x	x	x	x	
LO	Define ‘capacitance’ and ‘permittivity’, and state their relationship with density.	x	x	x	x	x	

LO	List and explain the parameters that can affect the measurement of the volume and/or mass of the fuel in a wing fuel tank: temperature; aircraft accelerations and attitudes, and explain how the fuel-gauge system design compensates for these changes.	X	X	X	X	X	
LO	Describe and explain the operating principles of the following types of fuel gauges: float system; capacitance type fuel-gauge system; ultrasound type of fuel gauge: to be introduced at a later date.	x	x	x	x	x	
022 01 04 00	**Fuel flowmeters**						
LO	Define 'fuel flow' and where it is measured.	x	x	x	x	x	
LO	State that fuel flow may be measured by volume or mass per unit of time.	x	x	x	x	x	
LO	List the following units used for fuel flow when measured by mass per hour: kilogrammes/hour, pounds/hour.	x	x	x	x	x	
LO	List the following units used for fuel flow when measured by volume per hour: litres/hour, US gallons/hour.	x	x	x	x	x	
LO	List and describe the following different types of fuel flowmeter: mechanical, electrical (analogue), electronic (digital), and explain how the signal can be corrected to measure mass flow.	x	x	x	x	x	
LO	Explain how total fuel consumption is obtained.	x	x	x	x	x	
022 01 05 00	**Tachometer**						

LO	List the following types of tachometers: mechanical (rotating magnet); electrical (three-phase tacho-generator); electronic (impulse measurement with speed probe and phonic wheel); and describe the operating principle of each type.	x	x	x	x	x	
LO	For each type, identify applications such as engine-speed measurement (crankshaft speed for piston engines, spool speed for gas turbine engines), wheel-speed measurement for anti-skid systems (anti-skid systems for aeroplane only), and give examples of display.	x	x	x	x	x	
LO	State that engine speed is most commonly displayed as a percentage.	x	x	x	x	x	
022 01 06 00	**Thrust measurement**						
LO	List and describe the following two parameters used to represent thrust: N1, EPR.	x	x				
LO	Explain the operating principle of the EPR gauge and the consequences for the pilot in case of a malfunction including blockage and leakage.	x	x				
LO	Give examples of display for N1 and EPR.	x	x				
022 01 07 00	**Engine torquemeter**						
LO	Define 'torque'.	x	x	x	x	x	
LO	Explain the relationship between power, torque and RPM.	x	x	x	x	x	
LO	List the following units used for torque: Newton meters, inch or foot pounds.	x	x	x	x	x	
LO	State that engine torque can be displayed as a percentage.	x	x	x	x	x	
LO	List and describe the following different types of torquemeters: mechanical, electronic, and explain their operating principles.	x	x	x	x	x	
LO	Compare the two systems with regard to design and weight.	x	x	x	x	x	

LO	Give examples of display.	x	x	x	x	x	
022 01 08 00	**Synchroscope**						
LO	State the purpose of a synchroscope.	x	x				
LO	Explain the operating principle of a synchroscope.	x	x				
LO	Give examples of display.	x	x				
022 01 09 00	**Engine-vibration monitoring**						
LO	State the purpose of a vibration-monitoring system for a jet engine.	x	x				
LO	Describe the operating principle of a vibration-monitoring system using the following two types of sensors: piezoelectric crystal, magnet.	x	x				
LO	State that no specific unit is displayed for a vibration-monitoring system.	x	x				
LO	Give examples of display.	x	x				
022 01 10 00	**Time measurement**						
LO	Explain the use of time/date measurement and recording for engines and system maintenance.	x	x	x	x	x	
022 02 00 00	**MEASUREMENT OF AIR-DATA PARAMETERS**						
022 02 01 00	**Pressure measurement**						
022 02 01 01	**Definitions**						
LO	Define ‘static, total and dynamic pressures’ and state the relationship between them.	x	x	x	x	x	x
LO	Define ‘impact pressure’ as total pressure minus static pressure and discuss the conditions when dynamic pressure equals impact pressure.	x	x	x	x	x	x
022 02 01 02	**Pitot/static system: design and errors**						
LO	Describe the design and the operating principle of a: static source, pitot tube, combined pitot/static probe.	x	x	x	x	x	x

LO	For each of these indicate the various locations, and describe the following associated errors: position errors; instrument errors; errors due to a non-longitudinal axial flow (including manoeuvre-induced errors); and the means of correction and/or compensation.	x	x	x	x	x	x
LO	Describe a typical pitot/static system and list the possible outputs.	x	x	x	x	x	x
LO	Explain the redundancy and the interconnections of typical pitot/static systems.	x	x	x	x	x	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed pressure.	x	x	x	x	x	x
LO	List the affected instruments and explain the consequences for the pilot in case of a malfunction including blockage and leakage.	x	x	x	x	x	x
LO	Describe alternate static sources and their effects when used.	x	x	x	x	x	x
LO	Solid-state sensors (to be introduced at a later date).	x	x	x	x	x	x
022 02 02 00	**Temperature measurement**						
022 02 02 01	**Definitions**						
LO	Define ‘OAT’, ‘SAT’, ‘TAT’ and ‘measured temperature’.	x	x	x	x	x	x
LO	Define ‘ram rise’ and ‘recovery factor’.	x					
LO	State the relationship between the different temperatures according to Mach number.	x					
022 02 02 02	**Design and operation**						
LO	Describe the following types of air-temperature probes and their features: expansion type: bimetallic strip, direct reading; electrical type wire resistance, remote reading.	x	x	x	x	x	x

LO	For each of these indicate the various locations, and describe the following associated errors: position errors, instrument errors, and the means of correction and/or compensation.	x	x	x	x	x	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed temperature.	x	x	x	x	x	x
022 02 03 00	**Angle-of-attack measurement**						
LO	Describe the following two types of angle-of-attack sensors: null-seeking (slotted) probe, vane detector.	x	x				
LO	For each type, explain the operating principles.	x	x				
LO	Explain how both types are protected against ice.	x	x				
LO	Give examples of systems that use the angle of attack as an input, such as: air-data computer; Stall Warning Systems; flight-envelope protection systems.	x	x				
LO	Give examples of different types of angle-of-attack (AoA) displays.	x	x				
022 02 04 00	**Altimeter**						
LO	Define 'ISA'.	x	x	x	x	x	x
LO	List the following two units used for altimeters: feet, metres, and state the relationship between them.	x	x	x	x	x	x
LO	Define the following terms: height, altitude; indicated altitude, true altitude; pressure altitude, density altitude.	x	x	x	x	x	x
LO	Define the following barometric references: 'QNH', 'QFE', '1013,25'.	x	x	x	x	x	x

LO	Explain the operating principles of an altimeter.	x	x	x	x	x	x
LO	Describe and compare the following three types of altimeters: simple altimeter (single capsule); sensitive altimeter (multi-capsule); servoassisted altimeter.	x	x	x	x	x	x
LO	Give examples of associated displays: pointer, multi-pointer, drum, vertical straight scale.	x	x	x	x	x	x
LO	Describe the following errors: pitot/static system errors; temperature error (air column not at ISA conditions); time lag (altimeter response to change of height); and the means of correction.	x	x	x	x	x	x
LO	Give examples of altimeter corrections table from an Aircraft Operating Handbook (AOH).	x	x	x	x	x	x
LO	Describe the effects of a blockage or a leakage on the static pressure line.	x	x	x	x	x	x
022 02 05 00	**Vertical Speed Indicator (VSI)**						
LO	List the two units used for VSI: metres per second, feet per minute, and state the relationship between them.	x	x	x	x	x	x
LO	Explain the operating principles of a VSI.	x	x	x	x	x	x
LO	Describe and compare the following two types of vertical speed indicators: barometric type, inertial type (inertial information provided by an inertial reference unit).	x	x	x	x	x	x
LO	Describe the following VSI errors: pitot/static system errors, time lag, and the means of correction.	x	x	x	x	x	x
LO	Describe the effects on a VSI of a blockage or a leakage on the static pressure line.	x	x	x	x	x	x

LO	Give examples of a VSI display.	x	x	x	x	x	x
022 02 06 00	**Airspeed Indicator (ASI)**						
LO	List the following three units used for airspeed: nautical miles/hour (knots), statute miles/hour, kilometres/hour, and state the relationship between them.	x	x	x	x	x	x
LO	Define 'IAS', 'CAS', 'EAS', 'TAS' and state and explain the relationship between these speeds.	x	x	x	x	x	x
LO	Describe the following ASI errors and state when they must be considered: pitot/static system errors, compressibility error, density error.	x	x	x	x	x	x
LO	Explain the operating principles of an ASI (as appropriate to aeroplanes or helicopters).	x	x	x	x	x	x
LO	Give examples of an ASI display: pointer, vertical straight scale.	x	x	x	x	x	x
LO	Interpret ASI corrections tables as used in an Aircraft Operating Handbook (AOH).	x	x	x	x	x	x
LO	Define and explain the following colour codes that can be used on an ASI: white arc (flap operating speed range); green arc (normal operating speed range); yellow arc (caution speed range); red line (VNE); blue line (best rate of climb speed, one-engine-out for multi-engine piston light aeroplanes).	x	x				
LO	Describe the effects on an ASI of a blockage or a leakage in the static and/or total pressure line(s).	x	x	x	x	x	x
022 02 07 00	**Machmeter**						
LO	Define 'Mach number' and 'Local Speed of Sound' (LSS), and perform simple calculations that include these terms.	x					
LO	Describe the operating principle of a Machmeter.	x					

LO	Explain why a Machmeter suffers only from pitot/static system errors.	x					
LO	Give examples of a Machmeter display: pointer, drum, vertical straight scale, digital.	x					
LO	Describe the effects on a Machmeter of a blockage or a leakage in the static and/or total pressure line(s).	x					
LO	State the relationship between Mach number, CAS and TAS, and interpret their variations according to FL and temperature changes.	x					
LO	State the existence of MMO.	x					
022 02 08 00	**Air-Data Computer (ADC)**						
LO	Explain the operating principle of an ADC.	x		x	x		
LO	List the following possible input data: TAT, static pressure, total pressure, measured temperature, angle of attack, flaps and landing gear position, stored aircraft data.	x		x	x		
LO	List the following possible output data: IAS, TAS, SAT, TAT, Mach number, angle of attack, altitude, vertical speed, VMO/MMO pointer.	x		x	x		
LO	For each output, list the datum/data sensed and explain the principle of calculation.	x		x	x		

LO	Explain how position, instrument, compressibility and density errors can be compensated/corrected to achieve a TAS calculation.	x		x	x		
LO	Explain why accuracy is improved for each output datum when compared to raw data.	x		x	x		
LO	Give examples of instruments and/or systems which may use ADC output data.	x		x	x		
LO	State that an ADC can be a stand-alone system or integrated with the Inertial Reference Unit (ADIRU).	x		x	x		
LO	Explain the ADC architecture for air-data measurement including sensors, processing units and displays, as opposed to stand-alone air-data measurement instruments.	x		x	x		
LO	Explain the advantage of an ADC for air-data information management compared to raw data.	x		x	x		
022 03 00 00	**MAGNETISM — DIRECT-READING COMPASS AND FLUX VALVE**						
022 03 01 00	**Earth's magnetic field**						
LO	Describe the magnetic field of the Earth.	x	x	x	x	x	x
LO	Explain the properties of a magnet.	x	x	x	x	x	x
LO	Define the following terms: magnetic variation, magnetic dip (inclination).	x	x	x	x	x	x
022 03 02 00	**Aircraft magnetic field**						
LO	Define and explain the following terms: magnetic and non-magnetic material; hard and soft iron; permanent magnetism and electromagnetism.	x	x	x	x	x	x
LO	Explain the principles and the reasons for: compass swinging (determination of initial deviations); compass compensation (correction of deviations found); compass calibration (determination of residual deviations).	x	x	x	x	x	x

LO	List the causes of the aircraft's magnetic field and explain how it affects the accuracy of the compass indications.	x	x	x	x	x	x
LO	Describe the purpose and the use of a deviation correction card.	x	x	x	x	x	x
022 03 03 00	**Direct-reading magnetic compass**						
LO	Define the role of a direct-reading magnetic compass.	x	x	x	x	x	x
LO	Describe and explain the design of a vertical card-type compass.	x	x	x	x	x	x
LO	Describe the deviation compensation.	x	x	x	x	x	x
LO	Describe and interpret the effects of the following errors: acceleration, turning, attitude, deviation.	x	x	x	x	x	x
LO	Explain how to use and interpret the direct-reading compass indications during a turn.	x	x	x	x	x	x
022 03 04 00	**Flux valve**						
LO	Explain the purpose of a flux valve.	x	x	x	x	x	x
LO	Explain its operating principle.	x	x	x	x	x	x
LO	Indicate various locations and precautions needed.	x	x	x	x	x	x
LO	Give the remote-reading compass system as example of application.	x	x	x	x	x	x
LO	State that because of the electromagnetic deviation correction, the flux-valve output itself does not have a deviation correction card.	x	x	x	x	x	x
LO	Describe and interpret the effects of the following errors: acceleration, turning, attitude, deviation.	x	x	x	x	x	x
022 04 00 00	**GYROSCOPIC INSTRUMENTS**						

022 04 01 00	**Gyroscope: basic principles**						
LO	Define a 'gyro'.	x	x	x	x	x	x
LO	Explain the fundamentals of the theory of gyroscopic forces.	x	x	x	x	x	x
LO	Define the 'degrees of freedom' of a gyro. Remark: As a convention, the degrees of freedom of a gyroscope do not include its own axis of rotation (the spin axis).	x	x	x	x	x	x
LO	Explain the following terms: rigidity, precession, wander (drift/topple).	x	x	x	x	x	x
LO	Distinguish between: real wander and apparent wander; apparent wander due to the rotation of the Earth and transport wander.	x	x	x	x	x	x
LO	Describe a free (space) gyro and a tied gyro.	x	x	x	x	x	x
LO	Describe and compare electrically and pneumatically-driven gyroscopes.	x	x	x	x	x	x
LO	Explain the construction and operating principles of a: rate gyro, rate-integrating gyro.	x	x	x	x	x	x
022 04 02 00	**Rate-of-turn indicator — Turn coordinator — Balance (slip) indicator**						
LO	Explain the purpose of a rate-of-turn and balance (slip) indicator.	x	x	x	x	x	x
LO	Define a 'rate-one turn'.	x	x	x	x	x	x
LO	Describe the construction and principles of operation of a rate-of-turn indicator.	x	x	x	x	x	x
LO	State the degrees of freedom of a rate-of-turn indicator.	x	x	x	x	x	x
LO	Explain the relation between bank angle, rate of turn and TAS.	x	x	x	x	x	x
LO	Explain why the indication of a rate-of-turn indicator is only correct for one TAS and when turn is coordinated.	x	x	x	x	x	x

LO	Describe the construction and principles of operation of a balance (slip) indicator.	X	X	X	X	X	x
LO	Explain the purpose of a balance (slip) indicator.	x	x	x	x	x	x
LO	Describe the indications of a rate-of-turn and balance (slip) indicator during a balanced, slip or skid turn.	x	x	x	x	x	x
LO	Describe the construction and principles of operation of a turn coordinator (or turn-and-bank indicator).	x	x	x	x	x	x
LO	Compare the rate-of-turn indicator and the turn coordinator.	x	x	x	x	x	x
022 04 03 00	**Attitude indicator (artificial horizon)**						
LO	Explain the purpose of the attitude indicator.	x	x	x	x	x	x
LO	Describe the different designs and principles of operation of attitude indicators (air-driven, electric).	x	x	x	x	x	x
LO	State the degrees of freedom.	x	x	x	x	x	x
LO	Describe the gimbal system.	x	x	x	x	x	x
LO	Describe the effects of the aircraft's acceleration and turns on instrument indications.	x	x	x	x	x	x
LO	Describe the attitude display and instrument markings.	x	x	x	x	x	x
LO	Explain the purpose of a vertical gyro unit.	x	x	x	x	x	x
LO	List and describe the following components of a vertical gyro unit: inputs: pitch and roll sensors; transmission and amplification (synchros and amplifiers); outputs: display units such as Attitude Direction Indicator (ADI), auto-flight control systems.	x	x	x	x	x	x
LO	State the advantages and disadvantages of a vertical gyro unit compared to an attitude indicator with regard to: design (power source, weight and volume); accuracy of the information displayed; availability of the information for several systems (ADI, AFCS).	x	x	x	x	x	x
022 04 04 00	**Directional gyroscope**						

LO	Explain the purpose of the directional gyroscope.	x	x	x	x	x	x
LO	Describe the following two types of directional gyroscopes: air-driven directional gyro; electric directional gyro.	x	x	x	x	x	x
LO	State the degrees of freedom.	x	x	x	x	x	x
LO	Describe the gimbal system.	x	x	x	x	x	x
LO	Define the following different errors: design and manufacturing imperfections (random wander); apparent wander (rotation of the Earth); transport wander (movement relative to the Earth's surface); and explain their effects.	x	x	x	x	x	x
LO	Calculate the apparent wander (apparent drift rate in degrees per hour) of an uncompensated gyro according to latitude.	x	x	x	x	x	x
022 04 05 00	**Remote-reading compass systems**						
LO	Describe the principles of operation of a remote-reading compass system.	x	x	x	x	x	x
LO	Using a block diagram, list and explain the function of the following components of a remote-reading compass system: flux detection unit; gyro unit; transducers, precession amplifiers, annunciator; display unit (compass card, synchronising and set-heading knob, DG/compass switch).	x	x	x	x	x	x

LO	State the advantages and disadvantages of a remote-reading compass system compared to a direct-reading magnetic compass with regard to: design (power source, weight and volume); deviation due to aircraft magnetism; turning and acceleration errors; attitude errors; accuracy and stability of the information displayed; availability of the information for several systems (compass card, RMI, AFCS).	x	x	x	x	x	x
022 04 06 00	**Solid-state systems — AHRS (the following paragraph is to be introduced at a later date)**	x	x	x	x	x	x
LO	State that the Micro-Electromechanical Sensors (MEMS) technology can be used to make: solid-state accelerometers; solid-state rate sensor gyroscopes; solid-state magnetometers (measurement of the Earth's magnetic field).	x	x	x	x	x	x
LO	Describe the basic principle of a solid-state Attitude and Heading Reference System (AHRS) using a solid-state 3-axis rate sensor, 3-axis accelerometer and a 3-axis magnetometer.	x	x	x	x	x	x
LO	Compare the solid-state AHRS with the mechanical gyroscope and flux-gate system with regard to: size and weight, accuracy, reliability, cost.	x	x	x	x	x	x
022 05 00 00	**INERTIAL NAVIGATION AND REFERENCE SYSTEMS (INS AND IRS)**						
022 05 01 00	**Inertial Navigation Systems (INS) (stabilised inertial platform)**						
022 05 01 01	**Basic principles**						
LO	Explain the basic principles of inertial navigation.	x		x	x		
022 05 01 02	**Design**						

LO	List and describe the main components of a stabilised inertial platform.	x		x	x		
LO	Explain the different corrections made to stabilise the platform.	x		x	x		
LO	List the following two effects that must be compensated for: Coriolis, centrifugal.	x		x	x		
LO	Explain the alignment of the system, the different phases associated and the conditions required.	x		x	x		
LO	Explain the Schuler condition and give the value of the Schuler period.	x		x	x		
022 05 01 03	**Errors, accuracy**						
LO	State that there are three different types of errors: bounded errors, unbounded errors, other errors.	x		x	x		
LO	Give average values for bounded and unbounded errors according to time.	x		x	x		
LO	State that an average value for the position error of the INS according to time is 1,5 NM/hour or more.	x		x	x		
022 05 01 04	**Operation**						
LO	Give examples of INS control and display panels.	x		x	x		
LO	Give an average value of alignment time at midlatitudes.	x		x	x		
LO	List the outputs given by an INS.	x		x	x		
LO	Describe and explain the consequences concerning the loss of alignment by an INS in flight.	x		x	x		
022 05 02 00	**Inertial Reference Systems (IRS) (strapped-down)**						
022 05 02 01	**Basic principles**						
LO	Describe the operating principle of a strapped-down IRS.	x		x	x		

LO	State the differences between a strapped-down inertial system (IRS) and a stabilised inertial platform (INS).	x		x	x		
022 05 02 02	**Design**						
LO	List and describe the following main components of an IRS: rate sensors (laser gyros), inertial accelerometers, high-performance processors, display unit.	x		x	x		
LO	Explain the construction and operating principles of a Ring Laser Gyroscope (RLG).	x		x	x		
LO	Explain the different computations and corrections to be made to achieve data processing.	x		x	x		
LO	Explain the alignment of the system, the different phases associated and the conditions required.	x		x	x		
LO	Explain why the Schuler condition is still required.	x		x	x		
LO	Describe the 'lock-in' (laser lock) phenomena and the means to overcome it.	x		x	x		
LO	State that an IRS can be a stand-alone system or integrated with an ADC (ADIRU).	x		x	x		
022 05 02 03	**Errors, accuracy**						
LO	Compare IRS and INS for errors and accuracy.	x		x	x		
022 05 02 04	**Operation**						
LO	Compare IRS and INS, and give recent examples of control panels.	x		x	x		
LO	List the outputs given by an IRS.	x		x	x		
LO	Give the advantages and disadvantages of an IRS compared to an INS.	x		x	x		
022 06 00 00	**AEROPLANE: AUTOMATIC FLIGHT CONTROL SYSTEMS**						
022 06 01 00	**General: Definitions and control loops**						
LO	State the following purposes of an Automatic Flight Control System (AFCS): enhancement of flight controls; reduction of pilot workload.	x	x				

LO	Define and explain the following two functions of an AFCS: aircraft control: control of the aeroplane's movement about its centre of gravity (CG); aircraft guidance: guidance of the aeroplane's CG (flight path).	x	x				
LO	Define and explain 'closed loop' and open loop.	x	x				
LO	Explain that the inner loop is for aircraft control and outer loop is for aircraft guidance.	x	x				
LO	List the following different elements of a closed-loop control system and explain their function: input signal; error detector; signal processing (computation of output signal according to control laws); output signal; control element; feedback signal.	x	x				
022 06 02 00	**Autopilot system: design and operation**						
LO	Define the three basic control channels.	x	x				
LO	List the following different types of autopilot systems: 1-axis, 2-axis and 3-axis.	x	x				
LO	List and describe the main components of an autopilot system.	x	x				
LO	Explain and describe the following lateral modes: roll, heading, VOR/LOC, NAV or LNAV.	x	x				
LO	Describe the purpose of control laws for pitch and roll modes.	x	x				
LO	Explain and describe the following longitudinal (or vertical) modes: pitch, vertical speed, level change, altitude hold (ALT), profile or VNAV, G/S.	x	x				
LO	Give basic examples for pitch and roll channels of inner loops and outer loops with the help of a diagram.	x	x				
LO	Explain the influence of gain variation on precision and stability.	x	x				
LO	Explain gain adaptation with regard to speed, configuration or flight phase.	x	x				

LO	Explain and describe the following common (or mixed) modes: take-off, go-around and approach. Remark: The landing sequence is studied in 022 06 04 00.	x	x				
LO	List the different types of actuation configuration and compare their advantages/disadvantages.	x	x				
LO	List the inputs and outputs of a 3-axis autopilot system.	x	x				
LO	Describe and explain the synchronisation function.	x	x				
LO	Give examples of engagement and disengagement systems and conditions.	x	x				
LO	Define the 'Control Wheel Steering' (CWS) mode according to CS-25 (see AMC 25.1329, paragraph 4.3).	x	x				
LO	Describe the CWS mode operation.	x	x				
LO	Describe with the help of a control panel of an autopilot system and a flight mode annunciator/indicator the actions and the checks performed by a pilot through a complete sequence: from Heading (HDG) selection to VOR/LOC guidance (arm/capture/ track); from Altitude selection (LVL change) to Altitude (ALT) hold (arm/intercept/ hold).	x	x				
LO	Describe and explain the different phases and the associated annunciations/ indications from level change to altitude capture and from heading mode to VOR/ LOC capture.	x	x				
LO	Describe and explain the existence of operational limits for lateral modes (LOC capture) with regard to speed/angle of interception/distance to threshold, and for longitudinal modes (ALT or G/S capture) with regard to V/S.	x	x				
022 06 03 00	**Flight Director: design and operation**						
LO	State the purpose of a Flight Director (FD) system.	x	x				
LO	List and describe the main components of an FD system.	x	x				
LO	List the different types of display.	x	x				

LO	Explain the differences between an FD system and an Autopilot (AP) system.	x	x				
LO	Explain how an FD and an AP can be used together, separately (AP with no FD, or FD with no AP), or none of them.	x	x				
LO	Give examples of different situations with the respective indications of the command bars.	x	x				
022 06 04 00	**Aeroplane: Flight Mode Annunciator (FMA)**						
LO	Explain the purpose and the importance of the FMA.	x	x				
LO	State that the FMA provides: AFCS lateral and vertical modes; auto-throttle modes; FD selection, AP engagement and automatic landing capacity; failure and alert messages.	x	x				
022 06 05 00	**Autoland: design and operation**						
LO	Explain the purpose of an autoland system.	x					
LO	List and describe the main components of an autoland system.	x					
LO	Define the following terms: 'fail passive system'; 'fail operational' (fail active) system; alert height; according to CS-AWO.	x					
LO	Describe and explain the autoland sequence and the associated annunciations/indications from initial approach to roll-out (AP disengagement) or go-around.	x					
LO	List and explain the operational limitations to perform an autoland.	x					
022 07 00 00	**HELICOPTER: AUTOMATIC FLIGHT CONTROL SYSTEMS**						
022 07 01 00	**General principles**						
022 07 01 01	**Stabilisation**						

LO	Explain the similarities and differences between SAS and AFCS (the latter can actually fly the helicopter to perform certain functions selected by the pilot). Some AFCSs just have altitude and heading hold whilst others include a vertical speed or IAS hold mode, where a constant rate of climb/decent or IAS is maintained by the AFCS.			x	x	x	
022 07 01 02	**Reduction of pilot workload**						
LO	Appreciate how effective the AFCS is in reducing pilot workload by improving basic aircraft control harmony and decreasing disturbances.			x	x	x	
022 07 01 03	**Enhancement of helicopter capability**						
LO	Explain how an AFCS improves helicopter flight safety during: search and rescue because of increased capabilities; flight by sole reference to instruments; underslung load operations; white-out conditions in snow-covered landscapes; an approach to land with lack of visual cues.			x	x	x	
LO	Explain that the Search and Rescue (SAR) modes of AFCS include the following functions: ability to autohover; automatically transition down from cruise to a predetermined point or over-flown point; ability for the rear crew to move the helicopter around in the hover; the ability to automatically transition back from the hover to cruise flight; the ability to fly various search patterns.			x	x	x	
LO	Explain that the earlier autohover systems use Doppler velocity sensors and the later systems use inertial sensors plus GPS, and normally include a two-dimensional hover-velocity indicator for the pilots.			x	x	x	
LO	Explain why some SAR helicopters have both radio-altimeter height hold and barometric altitude hold.			x	x	x	
022 07 01 04	**Failures**						
LO	Explain the various redundancies and independent systems that are built into the AFCSs.			x	x	x	
LO	Appreciate that the pilot can override the system in the event of a failure.			x	x	x	

LO	Explain a series actuator ‘hard over’ which equals aircraft attitude runaway.			x	x	x	
LO	Explain the consequences of a saturation of the series actuators.			x	x	x	
022 07 02 00	**Components: Operation**						
022 07 02 01	**Basic sensors**						
LO	Explain the basic sensors in the system and their functions.			x	x	x	
LO	Explain that the number of sensors will be dependent on the number of couple modes of the system.			x	x	x	
022 07 02 02	**Specific sensors**						
LO	Explain the function of the microswitches and strain gauges in the system which sense pilot input to prevent excessive feedback forces from the system.			x	x	x	
022 07 02 03	**Actuators**						
LO	Explain the principles of operation of the series and parallel actuators, spring-box clutches and the autotrim system.			x	x	x	
LO	Explain the principle of operation of the electronic hydraulic actuators in the system.			x	x	x	
022 07 02 04	**Pilot/system interface: control panels, system indication, warnings**						
LO	Describe the typical layout of the AFCS control panel.			x	x	x	
LO	Describe the system indications and warnings.			x	x	x	
022 07 02 05	**Operation**						
LO	Explain the functions of the redundant sensors’ simplex and duplex channels (single/dual channel).			x	x	x	
022 07 03 00	**Stability Augmentation System (SAS)**						
022 07 03 01	**General principles and operation**						

LO	Explain the general principles and operation of an SAS with regard to: rate damping; short-term attitude hold; effect on static stability; effect on dynamic stability; aerodynamic cross-coupling; effect on manoeuvrability; control response; engagement/disengagement; authority.			x	x	x	
LO	Explain and describe the general working principles and primary use of SAS by damping pitch, roll and yaw motions.			x	x	x	
LO	Describe a simple SAS with forced trim system which uses magnetic clutch and springs to hold cyclic control in the position where it was last released.			x	x	x	
LO	Explain the interaction of trim with SAS/Stability and Control Augmentation System (SCAS).			x	x	x	
LO	Appreciate that the system can be overridden by the pilot and individual channels deselected.			x	x	x	
LO	Describe the operational limits of the system.			x	x	x	
LO	Explain why the system should be turned off in severe turbulence or when extreme flight attitudes are reached.			x	x	x	
LO	Explain the safety design features built into some SASs to limit the authority of the actuators to 10–20 % of the full-control throw in order to allow the pilot to override if actuators demand an unsafe control input.			x	x	x	
LO	Explain how cross-coupling produces an adverse effect on roll to yaw coupling, when the helicopter is subject to gusts.			x	x	x	
LO	Explain the collective-to-pitch coupling, side-slip-to-pitch coupling and inter-axis coupling.			x	x	x	
022 07 04 00	**Autopilot — Automatic stability equipment**						
022 07 04 01	**General principles**						
LO	Explain the general autopilot principles with regard to: long-term attitude hold; fly-through; changing the reference (beep trim, trim release).			x	x	x	

022 07 04 02	**Basic modes (3/4 axes)**						
LO	Explain the AFCS operation on cyclic axes (pitch/roll), yaw axis, and on collective (fourth axis).			x	x	x	
022 07 04 03	**Automatic guidance (upper modes of AFCS)**						
LO	Explain the function of the attitude-hold system in an AFCS.			x	x	x	
LO	Explain the function of the heading-hold system in an AFCS.			x	x	x	
LO	Explain the function of the vertical-speed hold system in an AFCS.			x	x	x	
LO	Explain the function of the navigation-coupling system in an AFCS.			x	x	x	
LO	Explain the function of the VOR/ILS-coupling system in an AFCS.			x	x	x	
LO	Explain the function of the hover-mode system in an AFCS (including Doppler and radio altimeter systems).			x	x	x	
LO	Explain the function of the SAR mode (automatic transition to hover and back to cruise) in an AFCS.			x	x	x	
022 07 04 04	**Flight Director: design and operation**						
LO	Explain the purpose of a Flight Director (FD) system.			x	x	x	
LO	List the different types of display.			x	x	x	
LO	State the difference between the FD system and the autopilot system. Explain how each can be used independently.			x	x	x	
LO	List and describe the main components of an FD system.			x	x	x	
LO	Give examples of different situations with the respective indications of the command bars.			x	x	x	
LO	Explain the architecture of the different FDs fitted to helicopters and the importance to monitor other instruments as well as the FD, because on some helicopter types which have the collective setting on the FD, there is no protection against a collective transmission overtorque.			x	x	x	

LO	Describe the collective setting and yaw depiction on FD for some helicopters.			x	x	x	
022 07 04 05	**Automatic Flight Control Panel (AFCP)**						
LO	Explain the purpose and the importance of the AFCP.			x	x	x	
LO	State that the AFCP provides: AFCS basic and upper modes; FD selection, SAS and AP engagement; failure and alert messages.			x	x	x	
022 08 00 00	**TRIMS — YAW DAMPER — FLIGHT-ENVELOPE PROTECTION**						
022 08 01 00	**Trim systems: design and operation**						
LO	Explain the purpose of the trim system.	x	x				
LO	State the existence of a trim system for each of the three axes.	x	x				
LO	Give examples of trim indicators and their function.	x	x				
LO	Describe and explain an automatic pitch-trim system for a conventional aeroplane.	x	x				
LO	Describe and explain an automatic pitch-trim system for a fly-by-wire aeroplane.	x					
LO	State that for a fly-by-wire aeroplane the automatic pitch-trim system operates also during manual flight.	x					
LO	Describe the consequences of manual operation on the trim wheel when the automatic pitch-trim system is engaged.	x	x				
LO	Describe and explain the engagement and disengagement conditions of the autopilot according to trim controls.	x	x				
LO	Define 'Mach trim' and state that the Mach-trim system can be independent.	x	x				
LO	State that for a fly-by-wire aeroplane an autotrim system can be available for each of the three axes. *Remark: For the fly-by-wire LOs, please refer to reference 21.5.4.0.*	x	x				
022 08 02 00	**Yaw damper: design and operation**						
LO	Explain the purpose of the yaw-damper system.	x	x				

LO	List and describe the main components of a yaw-damper system.	x	x				
LO	Explain the purpose of the Dutch-roll filter (filtering of the yaw input signal).	x	x				
LO	Explain the operation of a yaw-damper system and state the difference between a yaw-damper system and a 3-axis autopilot operation on the rudder channel.	x	x				
022 08 03 00	**Flight-Envelope Protection (FEP)**						
LO	Explain the purpose of the FEP.	x					
LO	List the input parameters of the FEP.	x					
LO	Explain the following functions of the FEP: stall protection, overspeed protection.	x					
LO	State that the stall protection function and the overspeed protection function apply to both mechanical/conventional and fly-by-wire control systems, but other functions (e.g. pitch or bank limitation) can only apply to fly-by-wire control systems.	x					
022 09 00 00	**AUTO-THROTTLE — AUTOMATIC THRUST CONTROL SYSTEM**						
LO	State the purpose of the auto-throttle (AT) system.	x					
LO	Explain the operation of an AT system with regard to the following modes: take-off/go-around; climb or Maximum Continuous Thrust (MCT): N1 or EPR targeted; speed; idle thrust; landing (‘flare’ or ‘retard’).	x					

LO	Describe the control loop of an AT system with regard to: inputs: mode selection unit and switches (disengagement and engagement: TO-GA switches), radio altitude, air–ground logic switches; error detection: comparison between reference values (N1 or EPR, speed) and actual values; signal processing (control laws of the thrust-lever displacement according to error signal); outputs: AT servo-actuator; feedback: Thrust Lever Angle (TLA), data from ADC (TAS, Mach number), engine parameters (N1 or EPR).	x					
LO	State the existence of AT systems where thrust modes are determined by the lever position (no thrust mode panel or thrust rating panel, no TOGA switches).	x					
LO	Explain the limitations of an AT system in case of turbulence.	x					
022 10 00 00	**COMMUNICATION SYSTEMS**						
022 10 01 00	**Voice communication, data link transmission**						
022 10 01 01	**Definitions and transmission modes**						
LO	State the purpose of a data link transmission system.	x					
LO	Compare voice communication versus data link transmission systems.	x					
LO	State that VHF, HF and SATCOM devices can be used for voice communication and data link transmission.	x					
LO	State the advantages and disadvantages of each transmission mode with regard to: range; line-of-sight limitations; quality of the signal received; interference due to ionospheric conditions; data transmission speed.	x					
LO	State that the satellite communication networks do not cover extreme polar regions.	x					

LO	Define 'downlink and uplink communications'.	x					
LO	State that a D-ATIS is an ATIS message received by data link.	x					
022 10 01 02	**Systems: Architecture, design and operation**						
LO	Name the two following data link service providers: SITA, ARINC, and state their function.	x					
LO	Describe the ACARS network.	x					
LO	Describe the two following systems using the VHF/HF/Satcom data link transmission: Aircraft Communication Addressing and Reporting System (ACARS); Air Traffic Service Unit (ATSU).	x					
LO	List and describe the following possible onboard components of an ATSU: communications management unit (VHF/HF/SATCOM); Data Communication Display Unit (DCDU); Multi-Control Display Unit (MCDU) for AOC, ATC and messages from the crew (downlink communication); ATC message visual warning; printer.	x					
LO	Give examples of Airline Operations Communications (AOC) data link messages such as: Out of the gate, Off the ground, On the ground, Into the gate (OOOI); load sheet; passenger information (connecting flights); weather reports (METAR, TAF); maintenance reports (engine exceedances); free-text messages.	x					

LO	Give examples of Air Traffic Communications (ATC) data link messages such as: departure clearance, oceanic clearance.	x					
022 10 02 00	**Future Air Navigation Systems (FANS)**						
LO	State the existence of the ICAO Communication, Navigation, Surveillance/ Air Traffic Management (CNS/ATM) concept.	x					
LO	Define and explain the 'FANS concept' (including FANS A and FANS B).	x					
LO	State that FANS A uses the ACARS network.	x					
LO	List and explain the following FANS A applications: ATS Facility Notification (AFN); Automatic Dependent Surveillance (ADS); Controller–Pilot Data Link Communications (CPDLC).	x					
LO	Compare the ADS application with the secondary surveillance radar function, and the CPDLC application with VHF communication systems.	x					
LO	State that an ATC centre can use the ADS application only, or the CPDLC application only, or both of them (not including AFN).	x					
LO	Describe a notification phase (LOG ON) and state its purpose.	x					
LO	List the different types of messages of the CPDLC function and give examples of CPDLC data link messages.	x					
LO	List the different types of ADS contracts: periodic, on demand, on event, emergency mode.	x					
LO	State that the controller can modify the 'periodic', 'on demand' and 'on event' contracts or the parameters of these contracts (optional data groups), and that these modifications do not require crew notification.	x					
LO	Describe the 'emergency mode'.	x					

022 11 00 00	**FLIGHT MANAGEMENT SYSTEM (FMS)**						
LO	Remark: The use of an FMS as a navigation system is detailed in Radio Navigation (062), reference 062 05 04 00.						
022 11 01 00	**Design**						
LO	State the purpose of an FMS.	x		x	x		
LO	Describe a typical dual FMS architecture.	x		x	x		
LO	Describe the different possible configurations of this architecture during degraded modes of operation.	x		x	x		
LO	List the possible inputs and outputs of an FMS. Remark: No standard of FMS can be given because the FMS is type specific for aircraft manufacturers and the FMS standard is defined by the airline customer.	x		x	x		
LO	Describe the interfaces of the FMS with AFCS.	x		x	x		
LO	Describe the interfaces of the FMS with the AT system.	x					
022 11 02 00	**Navigation database, aircraft database**						
LO	Describe the contents and the main features of the navigation database and of the aircraft database: read-only information, updating cycle.	x		x	x		
LO	Define and explain the 'performance factor'.	x		x	x		
022 11 03 00	**Operations, limitations**						
LO	List and describe data computation and functions including position computations (multisensors), flight management, lateral/vertical navigation and guidance.	x		x	x		
LO	State the difference between computations based on measured data (use of sensors) and computations based on database information and give examples.	x		x	x		
LO	Define and explain the 'Cost Index' (CI).	x					
LO	Describe navigation accuracy computations and approach capability, degraded modes of operation: back-up navigation, use of raw data to confirm position/RAIM function for RNAV procedures.	x		x	x		

LO	Describe fuel computations with standard and non-standard configurations including one engine out, landing gear down, flaps, spoilers, use of the anti-icing system, increase of consumption due to an MEL/CDL item, etc.	x		x	x		
LO	Describe automatic radio navigation and tuning (COMM, NAV).	x		x	x		
022 11 04 00	**Man–machine interface (Multifunction Control Display Unit (MCDU))**						
LO	Give examples and describe the basic functions of the man–machine interface (MCDU).	x		x	x		
022 12 00 00	**ALERTING SYSTEMS, PROXIMITY SYSTEMS**						
022 12 01 00	**General**						
LO	State definitions, category, criteria and characteristics of alerting systems according to CS 25/AMJ 25.1322 for aeroplanes and CS-29 for helicopters as appropriate.	x	x	x	x	x	
022 12 02 00	**Flight Warning Systems (FWS)**						
LO	State the purpose of an FWS and list the typical sources (abnormal situations) of a warning and/or an alert.	x		x	x	x	
LO	List the main components of an FWS.	x		x	x	x	
022 12 03 00	**Stall Warning Systems (SWS)**						
LO	State the function of an SWS.	x	x				
LO	State the characteristics of an SWS according to CS 25.207(c).	x	x				
LO	List the different types of stall warning systems.	x	x				
LO	List the main components of an SWS.	x	x				
LO	List the inputs and outputs of an SWS.	x	x				
022 12 04 00	**Stall protection**						
LO	State the function of a stall protection system.	x					
LO	List the different types of stall protection systems including the difference between mechanical and fly-by-wire controls.	x					
LO	List the main components of a stall protection system.	x					
LO	List the inputs and outputs of a stall protection system.	x					

LO	Explain the difference between a stall warning system and a stall protection system.	x					
022 12 05 00	**Overspeed warning**						
LO	Explain the purpose of an overspeed warning system (VMO/MMO pointer).	x	x				
LO	Explain the design of a mechanical VMO/ MMO pointer.	x	x				
LO	State that for large aeroplanes, an aural warning must be associated to the overspeed warning if an electronic display is used (see AMC 25.11, paragraph 10.b(2), p. 2-GEN-22).	x	x				
LO	Give examples of VMO/MMO pointer: barber pole pointer, barber pole vertical scale.	x	x				
022 12 06 00	**Take-off warning**						
LO	State the purpose of a take-off warning system and list the typical abnormal situations which generate a warning (see AMC 25.703, paragraphs 4 and 5).	x					
022 12 07 00	**Altitude alert system**						
LO	State the function and describe an altitude alert system.	x	x	x	x	x	x
LO	List and describe the different types of displays and possible alerts.	x	x	x	x	x	x
022 12 08 00	**Radio altimeter**						
LO	State the function of a low-altitude radio altimeter.	x	x	x	x	x	x
LO	Describe the principle of the distance (height) measurement.	x	x	x	x	x	x
LO	State the bandwidth and frequency range used.	x	x	x	x	x	x
LO	List the different components of a radio altimeter and describe the different types of displays.	x	x	x	x	x	x
LO	List the systems using radio-altimeter information.	x	x	x	x	x	x
LO	State the range and accuracy of a radio altimeter.	x	x	x	x	x	x
LO	Describe and explain the cable-length compensation.	x	x	x	x	x	x
022 12 09 00	**Ground-proximity warning systems (GPWS)**						
022 12 09 01	**GPWS: design, operation, indications**						

LO	State the purpose of a ground-proximity warning system (GPWS).	x		x	x		
LO	List the components of a GPWS.	x		x	x		
LO	List the inputs and outputs of a GPWS.	x		x	x		
LO	List and describe the different modes of operation of a GPWS.	x		x	x		
022 12 09 02	**Terrain-Avoidance Warning System (TAWS), other name: Enhanced GPWS (EGPWS)**						
LO	State the purpose of a TAWS for aeroplanes and HTAWS for helicopters and explain the difference from a GPWS.	x		x	x		
LO	List the components of a TAWS/ HTAWS.	x		x	x		
LO	List the inputs and outputs of a TAWS/ HTAWS.	x		x	x		
LO	Give examples of terrain displays and list the different possible alerts.	x		x	x		
LO	Give examples of time response left to the pilot according to look-ahead distance, speed and aircraft performances.	x		x	x		
LO	Explain why the TAWS/HTAWS must be coupled to a precise-position sensor.	x		x	x		
022 12 09 03	**Runway awareness and advisory system (to be introduced at a later date)**						
LO	Explain that a runway awareness and advisory system is a software upgrade of the existing TAWS (EGPWS) to reduce runway incursions.	x					
022 12 10 00	**ACAS/TCAS principles and operations**	x	x	x	x	x	x
LO	State that ACAS II is an ICAO standard for anti-collision purposes.	x	x	x	x	x	x
LO	State that TCAS II version 7 is compliant with the ACAS II standard.	x	x	x	x	x	x
LO	Explain that ACAS II is an anti-collision system and does not guarantee any specific separation.	x	x	x	x	x	x
LO	Describe the purpose of an ACAS II system as an anti-collision system.	x	x	x	x	x	x
LO	Define a ‘Resolution Advisory’ (RA) and a ‘Traffic Advisory’ (TA).	x	x	x	x	x	x
LO	State that RAs are calculated in the vertical plane only (climb or descent).	x	x	x	x	x	x

LO	Explain the difference between a corrective RA and a preventive RA (no modification of vertical speed).	x	x	x	x	x	x
LO	Explain that if two aircraft are fitted with ACAS II, the RA will be coordinated.	x	x	x	x	x	x
LO	State that ACAS II equipment can take into account several threats simultaneously.	x	x	x	x	x	x
LO	State that a detected aircraft without altitude-reporting can only generate a TA.	x	x	x	x	x	x
LO	Describe the TCAS II system in with regard to: antenna used; computer and links with radio altimeter, air-data computer and mode-S transponder.	x	x	x	x	x	x
LO	Identify the inputs and outputs of TCAS II.	x	x	x	x	x	x
LO	Explain the principle of TCAS II interrogations.	x	x	x	x	x	x
LO	State that the standard detection range is approximately 30 NM.	x	x	x	x	x	x
LO	State that the normal interrogation period is 1 second.	x	x	x	x	x	x
LO	Explain the principle of 'reduced surveillance'.	x	x	x	x	x	x
LO	Explain that in high-density traffic areas the period can be extended to 5 seconds and the transmission power reduction can reduce the range detection down to 5 NM.	x	x	x	x	x	x
LO	Identify the equipment which an intruder must be fitted with in order to be detected by TCAS II.	x	x	x	x	x	x

LO	Explain in the anti-collision process: that the criteria used to trigger an alarm (TA or RA) are the time to reach the closest point of approach (called TAU) and the difference of altitude; that an intruder will be classified as 'proximate' when being less than 6 NM and 1 200 ft from the TCAS-equipped aircraft; that the time limit to CPA is different depending on aircraft altitude, is linked to a sensitivity level (SL), and state that the value to trigger an RA is from 15 to 35 seconds; that, in case of an RA, the intended vertical separation varies from 300 to 600 ft (700 ft above FL420), depending on the SL; that below 1 000 ft above ground, no RA can be generated; that below 1 450 ft (radio-altimeter value) 'increase descent' RA is inhibited; that, in high altitude, performances of the type of aircraft are taken into account to inhibit 'climb' and 'increase climb' RA.	x	x	x	x	x	x
LO	List and interpret the following information available from TCAS: the different possible statuses of a detected aircraft: other, proximate, intruder; the appropriate graphic symbols and their position on the horizontal display; different aural warnings.	x	x	x	x	x	x
LO	Explain that an RA is presented as a possible vertical speed on a TCAS indicator or on the Primary Flight Display (PFD).	x	x	x	x	x	x
LO	Describe the possible presentation of an RA on a VSI or on a PFD.	x	x	x	x	x	x
LO	Explain that the pilot must not interpret the horizontal track of an intruder upon the display.	x	x	x	x	x	x
022 12 11 00	**Rotor/engine overspeed alert system**						
022 12 11 01	**Design, operation, displays, alarms**						
LO	Describe the basic design principles, operation, displays and warning/alarm systems fitted to different helicopters.			x	x	x	

022 13 00 00	**INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS**						
022 13 01 00	**Electronic display units**						
022 13 01 01	**Design, limitations**						
LO	List the different technologies used, e.g. CRT and LCD, and the associated limitations: cockpit temperature, glare.	x	x	x	x	x	x
022 13 02 00	**Mechanical integrated instruments: Attitude and Director Indicator (ADI)/Horizontal Situation Indicator (HSI)**						
LO	Describe an ADI and an HSI.	x	x	x	x	x	x
LO	List all the information that can be displayed for either instruments.	x	x	x	x	x	x
022 13 03 00	**Electronic Flight Instrument Systems (EFIS)**						
	Remarks: 1 — The use of EFIS as navigation display system is also detailed in Radio Navigation (062), reference 062 05 05 02 (EFIS instruments). 2 — Reference to AMC 25-1322 can be used for aeroplanes only.						
022 13 03 01	**Design, operation**						
LO	List and describe the different components of an EFIS.	x	x	x	x	x	x
LO	List the following possible inputs and outputs of an EFIS: control panel, display units, symbol generator, remote-light sensor.	x	x	x	x	x	x
LO	Describe the function of the symbol generator unit.	x	x	x	x	x	x
022 13 03 02	**Primary Flight Display (PFD), Electronic Attitude Director Indicator (EADI)**						
LO	State that a PFD (or an EADI) presents a dynamic colour display of all the parameters necessary to control the aircraft.	x	x	x	x	x	x

LO	List and describe the following information that can be displayed on the PFD unit of an aircraft: flight mode annunciation; basic T: • attitude, • IAS, • altitude, • heading/track indications; vertical speed; maximum-airspeed warning; selected airspeed; speed-trend vector; selected altitude; current barometric reference; steering indications (FD command bars); selected heading; flight path vector (FPV); radio altitude; decision height; ILS indications; ACAS (TCAS) indications; failure flags and messages.	x	x	x	x	x	x
LO	List and describe the following information that can also be displayed on the PFD unit of an aeroplane: take-off and landing reference speeds; minimum airspeed; lower selectable airspeed; Mach number.	x					
022 13 03 03	**Navigation Display (ND), Electronic Horizontal Situation Indicator (EHSI)**						
LO	State that an ND (or an EHSI) provides a mode-selectable colour flight navigation display.	x	x	x	x	x	x

LO	List and describe the following four modes displayed on an ND unit: MAP (or ARC), VOR (or ROSE VOR), APP (or ROSE LS), PLAN.	x	x	x	x	x	x
LO	List and explain the following information that can be displayed with the MAP (or ARC) mode on an ND unit: selected and current track; selected and current heading (magnetic or true-north reference); cross-track error; origin and destination airport with runway selected; bearings to or from the tuned and selected stations; active and/or secondary flight plan; range marks; ground speed; TAS and ground speed; wind direction and speed; next-waypoint distance and estimated time of arrival; additional navigation facilities (STA), waypoint (WPT) and airports (ARPT); weather radar information; traffic information from the ACAS (TCAS); terrain information from the TAWS or HTAWS (EGPWS); failure flags and messages.	x	x	x	x	x	x

LO	List and explain the following information that can be displayed with the VOR/APP (or ROSE VOR/ROSE LS) mode on an ND unit: selected and current track; selected and current heading (magnetic or true-north reference) VOR course or ILS localizer course VOR (VOR or ROSE VOR mode) or LOC course deviation (APP or ROSE LS); glide-slope pointer (APP or ROSE LS); frequency or identifier of the tuned station; ground speed; TAS and ground speed; wind direction and speed; failure flags and messages.	x	x	x	x	x	x
LO	List and explain the following information that can be displayed with the PLAN mode on an ND unit: selected and current track; origin and destination airport with runway selected; active and/or secondary flight plan; range marks; ground speed; TAS and ground speed; wind direction and speed; next-waypoint distance and estimated time of arrival; additional navigation facilities (STA), waypoint (WPT) and airports (ARPT); failure flags and messages.	x	x				
LO	Give examples of possible transfers between units.	x	x	x	x	x	x
LO	Give examples of EFIS control panels.	x	x	x	x	x	x
022 13 04 00	**Engine parameters, crew warnings, aircraft systems, procedure and mission display systems**						

LO	State the purpose of the following systems: engine instruments centralised display unit; crew alerting system associated with an electronic checklist display unit; that the aircraft systems display unit enables the display of normal and degraded modes of operation of the aircraft systems.	x		x	x		
LO	Describe the architecture of each system and give examples of display.	x		x	x		
LO	Give the following different names by which engine parameters, crew warnings, aircraft systems and procedures display systems are known: Multifunction Display Unit (MFDU); Engine Indication and Crew Alerting Systems (EICAS); Engine and Warning Display (EWD); Electronic Centralised Aircraft Monitor (ECAM).	x					
LO	Give the names of the following different display systems and describe their main functions: Vehicle Engine Monitoring Display (VEMD); Integrated Instruments Display System (IIDS).			x	x		
LO	State the purpose of a mission display unit.			x	x		
LO	Describe the architecture of each system and give examples of display.			x	x		
022 13 05 00	**Engine first limit indicator**						
LO	Describe the principles of design and operation, and compare the different indications and displays available.			x	x	x	
LO	Describe what information can be displayed on the screen, when in the limited screen composite mode.			x	x	x	
022 13 06 00	**Electronic Flight Bag (EFB) (to be introduced at a later date)**						
022 14 00 00	**MAINTENANCE, MONITORING AND RECORDING SYSTEMS**						

LO	State the basic technologies used for this equipment and its performances. Remark: No knowledge of the applicable operational requirements is necessary.	x	x	x	x	x	x
022 14 01 00	**Cockpit Voice Recorder (CVR)**						
LO	State the purpose of a CVR.	x					
LO	List the main components of a CVR: a shock-resistant tape recorder associated with an underwater locating device; an area microphone; a control unit with the following controls: auto/on, test and erase, and a headset jack.	x					
LO	List the following main parameters recorded on the CVR: voice communications transmitted from or received on the flight deck; the aural environment of the flight deck; voice communication of flight crew members using the aeroplane's interphone system; voice or audio signals introduced into a headset or speaker; voice communication of flight crew members using the public address system, when installed.	x					
022 14 02 00	**Flight Data Recorders (FDR)**						
LO	State the purpose of an FDR.	x					
LO	List the main components of an FDR: a data interface and acquisition unit; a recording system (digital flight data recorder); two control units (start sequence, event mark setting).	x					

LO	List the following main parameters recorded on the FDR: time or relative time count; attitude (pitch and roll); airspeed; pressure altitude; heading; normal acceleration; propulsive/thrust power on each engine and cockpit thrust/power lever position, if applicable; flaps/slats configuration or cockpit selection; ground spoilers and/or speed brake selection.	x					
LO	State that additional parameters can be recorded according to FDR capacity and the applicable operational requirements.	x					
022 14 03 00	**Maintenance and monitoring systems**						
022 14 03 01	**Helicopter Operations Monitoring Programme (HOMP): design, operation, performance**						
LO	Describe the HOMP as a helicopter version of the aeroplane Flight Data Monitoring (FDM) programmes.			x	x		
LO	State that the HOMP software consists of three integrated modules: Flight Data Events (FDE); Flight Data Measurements (FDM); Flight Data Traces (FDT).			x	x		
LO	Describe and explain the information flow of HOMP.			x	x		
LO	Describe HOMP operation and management processes.			x	x		
022 14 03 02	**Integrated Health & Usage Monitoring System (IHUMS): design, operation, performance**						

LO	Describe the main features of IHUMS: rotor system health; cockpit voice recorder/flight data recorder; gearbox system health; engine health; exceedance monitoring; usage monitoring; transparent operation; ground station features; exceedance monitoring; monitoring; gearbox health; rotor track & balance; engine performance trending; usage monitoring; quality controlled to level 2.			x	x		
LO	Describe the ground station features of IHUMS.			x	x		
LO	Summarise the benefits of IHUMS including: reduced risk of catastrophic failure of rotor or gearbox; improved rotor track & balance giving lower vibration levels; accurate recording of flight exceedances; cockpit voice recorder/flight data recorder allows accurate accident /incident investigation & HOMP; maintenance cost savings.			x	x		
LO	State the benefits of IHUMS and HOMP.			x	x		
022 14 03 03	**Aeroplane Condition Monitoring System (ACMS): general, design, operation**						
LO	State the purpose of an ACMS.	x					

LO	Describe the structure of an ACMS including: inputs: aircraft systems (such as air conditioning, autoflight, flight controls, fuel, landing gear, navigation, pneumatic, APU, engine), MCDU; data management unit; recording unit: digital recorder; outputs: printer, ACARS or ATSU.	x					
LO	State that maintenance messages sent by an ACMS can be transmitted without crew notification.	x					
022 15 00 00	**DIGITAL CIRCUITS AND COMPUTERS**						
022 15 01 00	**Digital circuits and computers: General, definitions and design**						
LO	Define a 'computer' as a machine for manipulating data according to a list of instructions.	x		x	x		
LO	List the following main components of a stored-programme ('Von Neumann architecture') on a basic computer: Central Processing Unit (CPU) including the Arithmetic Logic Unit (ALU) and the control unit; memory; input and output devices (peripherals); and state their functions.	x		x	x		
LO	State the existence of the different buses and their function.	x		x	x		
LO	Define the terms 'hardware' and 'software'.	x		x	x		
LO	Define and explain the terms 'multitasking' and 'multiprocessing'.	x		x	x		
LO	With the help of the relevant 022 references, give examples of airborne computers, such as ADC, FMS, GPWS, etc., and list the possible peripheral equipment for each system.	x		x	x		
LO	Describe the principle of the following technologies used for memories: chip circuit, magnetic disk, optical disk.	x		x	x		

022 15 02 00	**Software: General, definitions and certification specifications**						
LO	State the difference between assembly languages, high-level languages and scripting languages.	x		x	x		
LO	Define the term ‘Operating System’ (OS) and give different examples including airborne systems such as FMS or ATSU (for aeroplanes only).	x		x	x		
LO	State the existence of ‘Software Considerations in Airborne Systems and Equipment Certification’ (see document referenced RTCA/DO-178B or EUROCAE ED-12B).	x		x	x		
LO	List the specific levels of safety criticality according to the EUROCAE ED-12B document.	x		x	x		

D. SUBJECT 031 — MASS AND BALANCE

(1) MASS DEFINITIONS

Allowed take-off mass

The mass taking into consideration all possible limitations for take-off including restrictions caused by regulated take-off mass and regulated landing mass.

Area load or floor load

The load (or mass) distributed over a defined area. Units of measurement used:

SI: N/m2, kg/m2;

Non-SI: psi, lb/ft2.

Basic empty mass

The mass of an aircraft plus standard items such as: unusable fuel; full operating fluids; fire extinguishers; emergency oxygen equipment. (The lowest mass that is used in FCL exams.)

Dry operating mass

The total mass of an aircraft ready for a specific type of operation excluding all usable fuel and traffic load. This mass includes items such as:

crew and crew baggage;

catering and removable passenger service equipment (food, beverages, potable water, lavatory chemicals, etc.);

special operational equipment (e.g. stretchers, rescue hoist, cargo sling).

In-flight mass

The mass of an aircraft in flight at a specified time.

Landing mass

The mass of the aircraft at landing.

Maximum structural in-flight mass with external loads (applicable to helicopters only)

The maximum permissible total mass of the helicopter with external loads.

Maximum structural landing mass

The maximum permissible total mass of the aircraft at landing under normal circumstances.

Maximum structural mass

The maximum permissible total mass of the aircraft at any time. It will be given only if there is no difference between maximum structural taxi mass, maximum structural take-off mass and maximum structural landing mass.

Maximum structural take-off mass

The maximum permissible total mass of the aircraft at commencement of take-off.

Maximum (structural) taxi mass or maximum (structural) ramp mass

The maximum permissible total mass of the aircraft at commencement of taxiing.

Minimum mass (applicable to helicopters only)

The minimum permissible total mass for specific helicopter operations.

Operating mass

The dry operating mass plus fuel but without traffic load.

Performance-limited landing mass

The mass subject to the destination airfield limitations. It must never exceed the maximum structural limit.

Performance-limited take-off mass

The take-off mass subject to departure airfield limitations. It must never exceed the maximum structural limit.

Ramp mass (see taxiing mass)

Regulated landing mass

The lower of performance-limited landing mass and maximum structural landing mass.

Regulated take-off mass

The lower of performance limited take-off mass and maximum structural take-off mass.

Running (or linear) load

The load (or mass) distributed over a defined length of a cargo compartment irrespective of load width. Units of measurement used:

SI: N/m, kg/m;

Non-SI: lb/in, lb/ft.

Take-off fuel

The total amount of usable fuel at take-off.

Take-off mass

The mass of the aircraft including everything and everyone contained in it at the commencement of take-off.

Taxi mass or ramp mass

The mass of the aircraft at the commencement of taxiing.

Traffic load

The total mass of passengers, baggage and cargo including any non-revenue load.

Zero-fuel mass

The dry operating mass plus traffic load but excluding fuel.

[

Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
031 00 00 00	**MASS AND BALANCE — AEROPLANES/HELICOPTERS**						
031 01 00 00	**PURPOSE OF MASS-AND-BALANCE CONSIDERATIONS**						
031 01 01 00	**Mass limitations**						
031 01 01 01	**Importance with regard to structural limitations**						
LO	Describe the relationship between aircraft mass and structural stress. *Remark: See also 021 01 01 00.*	x	x	x	x	x	
LO	Describe that mass must be limited to ensure adequate margins of strength.	x	x	x	x	x	
031 01 01 02	**Importance with regard to performance** *Remark: See also subjects 032/034 and 081/082.*						
LO	Describe the relationship between aircraft mass and performance.	x	x	x	x	x	
LO	Describe that aircraft mass must be limited to ensure adequate aircraft performance.	x	x	x	x	x	
LO	Describe that the actual aircraft mass must be known during flight as the basis for performance-related decisions.	x	x	x	x	x	
031 01 02 00 **031 01 02 01**	**Centre-of-gravity (CG) limitations** **Importance with regard to stability and controllability** **Remark: See also subjects 081/082.**						
LO	Describe the relationship between CG position and stability/controllability of the aircraft.	x	x	x	x		
LO	Describe the consequences if CG is in front of the forward limit.	x	x	x	x	x	
LO	Describe the consequences if CG is behind the aft limit.	x	x	x	x	x	
031 01 02 02	**Importance with regard to performance** *Remark: See also subjects 032/034 and 081/082.*						
LO	Describe the relationship between CG position and aircraft performance.	x	x	x	x		

LO	Describe the effects of CG position on performance parameters (speeds, altitude, endurance and range).	x	x	x	x	x	
031 02 00 00	**LOADING**						
031 02 01 00	**Terminology**						
031 02 01 01	**Mass terms**						
LO	Define the following mass terms: basic empty mass; dry operating mass; operating mass; take-off mass; landing mass; ramp/taxiing mass; in-flight mass (gross mass); zero-fuel mass.	x	x	x	x	x	
031 02 01 02	**Load terms (including fuel terms)** *Remark: See also subject 033.*						
LO	Define the following load terms: payload/traffic load; block fuel; taxiing fuel; take-off fuel; trip fuel; reserve fuel (contingency, alternate, final reserve and additional fuel); extra fuel.	x	x	x	x	x	
LO	Explain the relationship between the various load-and-mass components listed above.	x	x	x	x	x	
LO	Calculate the mass of particular components from other given components.	x	x	x	x	x	
LO	Convert fuel mass, volume and density given in different units used in aviation.	x	x	x	x	x	
031 02 02 00	**Mass limits**						
031 02 02 01	**Structural limitations**						
LO	Define the following structural limitations:	x	x	x	x	x	
LO	Maximum zero-fuel mass.	x					
LO	Maximum ramp/taxiing mass.	x					
LO	Maximum take-off mass.	x	x	x	x	x	
LO	Maximum in-flight (gross) mass.	x	x	x	x	x	
LO	Maximum in-flight (gross) mass with external load.			x	x	x	
LO	Maximum landing mass.	x	x	x	x	x	
031 02 02 02	**Performance limitations**						

LO	Define the following performance limitations: performance-limited take-off mass; performance-limited landing mass; regulated take-off mass; regulated landing mass.	x	x	x	x	x	
031 02 02 03	**Cargo-compartment limitations**						
LO	Define the following cargo-compartment limitations:	x	x	x	x	x	
LO	Maximum floor load (maximum load per unit of area).	x	x	x	x	x	
LO	Maximum running load (maximum load per unit of fuselage length).	x	x	x	x	x	
031 02 03 00	**Mass calculations**						
031 02 03 01	**Maximum masses for take-off and landing**						
LO	Calculate the maximum mass for take-off (regulated take-off mass) given mass-and-load components and structural/ performance limits.	x	x	x	x		
LO	Calculate the maximum mass for landing (regulated landing mass) given mass-and-load components and structural/ performance limits.	x	x	x	x		
LO	Calculate the allowed mass for take-off.	x	x	x	x		
031 02 03 02	**Allowed traffic load and fuel load**						
LO	Calculate the maximum allowed traffic load and fuel load in order not to exceed the given allowed take-off mass.	x	x	x	x	x	
LO	Calculate 'under load'/'over load' given allowed mass for take-off, operating mass and actual traffic load.	x	x	x	x	x	
031 02 03 03	**Use of standard masses for passengers, baggage and crew**						
LO	Extract the appropriate standard masses for passengers, baggage and crew from relevant documents or operator requirements.	x	x	x	x	x	
LO	Calculate the traffic load by using standard masses.	x	x	x	x	x	
031 03 00 00	**FUNDAMENTALS OF CENTRE-OF-GRAVITY CALCULATIONS**						
031 03 01 00	**Definition of Centre of Gravity (CG)**						
LO	Define and explain the meaning of 'CG'.	x	x	x	x	x	
031 03 02 00	**Conditions of equilibrium (balance of forces and balance of moments)**						

LO	Define ‘datum’ (reference point), ‘moment arm’ and ‘moment’.	x	x	x	x	x	
LO	Name the conditions of equilibrium.	x	x	x	x	x	
031 03 03 00	**Basic calculations of CG**						
LO	Resolve numerical problems using the principle of equilibrium of forces and moments.	x	x	x	x	x	
031 04 00 00	**MASS-AND-BALANCE DETAILS OF AIRCRAFT**						
031 04 01 00	**Contents of mass-and-balance documentation**						
031 04 01 01	**Datum, moment arm**						
LO	Name where the datum and moment arms for aircraft can be found.	x	x	x	x	x	
LO	Extract the appropriate data from given documents.	x	x	x	x	x	
031 04 01 02	**CG position as distance from datum**						
LO	Name where the CG position for an aircraft at basic empty mass can be found.	x	x	x	x	x	
LO	Name where the CG limits for an aircraft can be found.	x	x	x	x	x	
LO	Extract the CG limits from given aircraft documents.	x	x	x	x	x	
LO	State the different forms in presenting CG position as distance from datum or other references.	x	x	x	x	x	
031 04 01 03	**CG position as percentage of Mean Aerodynamic Chord (% MAC)** *Remark: Knowledge of the definition of MAC is covered under reference 081 01 01 05.*						
LO	Extract % MAC information from aircraft documents.	x	x				
LO	Explain the principle of using % MAC for the description of the CG position.	x	x				
LO	Calculate the CG position as % MAC.	x	x				
031 04 01 04	**Longitudinal CG limits**						
LO	Extract the appropriate data from given sample documents.	x	x	x	x	x	
031 04 01 05	**Lateral CG limits**						
LO	Extract the appropriate data from given sample documents.			x	x	x	
031 04 01 06	**Details of passenger and cargo compartments**						

LO	Extract the appropriate data (e.g. seating schemes, compartment dimensions and limitations) from given sample documents.	x	x	x	x	x	x
031 04 01 07	**Details of fuel system relevant to mass-and-balance considerations**						
LO	Extract the appropriate data (e.g. fuel-tank capacities and fuel-tank positions) from given sample documents.	x	x	x	x	x	x
031 04 02 00	**Determination of aircraft empty mass and CG position by weighing**						
031 04 02 01	**Weighing of aircraft (general aspects)**						
LO	Explain the general procedure and regulations for weighing of aircraft (conditions, intervals, reasons and requirements for reweighing). *Remark: See the applicable operational requirements.*	x	x	x	x	x	
LO	Extract and interpret entries from/in 'mass (weight) report' of an aircraft.	x	x	x	x	x	
031 04 02 02	**Calculation of mass and CG position of an aircraft using weighing data**						
LO	Calculate the mass and CG position of an aircraft from given reaction forces on jacking points.	x	x	x	x	x	
031 04 03 00	**Extraction of basic empty mass and CG data from aircraft documentation**						
031 04 03 01	**Basic empty mass (BEM) and/or dry operating mass (DOM)**						
LO	Extract values for BEM and/or DOM from given documents.	x	x	x	x	x	
031 04 03 02	**CG position and/or moment at BEM/DOM**						
LO	Extract values for CG position and moment at BEM and/or DOM from given documents.	x	x	x	x	x	
031 04 03 03	**Deviations from standard configuration**						
LO	Extract values from given documents for deviation from standard configuration as a result of varying crew, optional equipment, optional fuel tanks, etc.	x	x	x	x	x	
031 05 00 00	**DETERMINATION OF CG POSITION**						
031 05 01 00	**Methods**						
031 05 01 01	**Arithmetic method**						

LO	Calculate the CG position of aircraft by using the formula: CG position = sum of moments/total mass.	x	x	x	x	x	
031 05 01 02	**Graphic method**						
LO	Determine the CG position of aircraft by using the loading graphs given in sample documents.	x	x	x	x	x	
031 05 01 03	**Index method**						
LO	Explain the principle of the index method.	x	x	x	x	x	
LO	Define the terms 'index', 'loaded index' and 'dry operating index'.	x	x	x	x	x	
LO	State the advantage(s) of the index method.	x	x	x	x	x	
031 05 02 00	**Load and trim sheet**						
031 05 02 01	**General considerations**						
LO	Explain the principle and the purpose of load sheets.	x					
LO	Explain the principle and the purpose of trim sheets.	x					
031 05 02 02	**Load sheet and CG envelope for light aeroplanes and for helicopters**						
LO	Add loading data and calculate masses in a sample load sheet.	x	x	x	x	x	
LO	Calculate moments and CG positions.	x	x	x	x	x	
LO	Check CG position at zero-fuel mass and take-off mass to be within the CG envelope including last-minute changes, if applicable.	x	x	x	x	x	
031 05 02 03	**Load sheet for large aeroplanes**						
LO	Explain the purpose of load-sheet sections and the methods for establishing 'allowed mass for take-off', 'allowed traffic load' and 'under load'.	x					
LO	Explain the purpose of load-sheet sections and the methods for assessing load distribution.	x					
LO	Explain the purpose of load-sheet sections and methods for cross-checking the actual and limiting mass values.	x					
LO	Calculate and/or complete a sample load sheet.	x					
031 05 02 04	**Trim sheet for large aeroplanes**						
LO	Explain the purpose of the trim sheet and the methods to determine the CG position.	x					
LO	Check that the zero-fuel mass index is within the limits.	x					

LO	Determine the fuel index by using the 'fuel index correction table' and determine the CG position as % MAC.	x					
LO	Check that the take-off mass index is within the limits.	x					
LO	Determine 'stabiliser trim units' for take-off.	x					
LO	Explain the difference between certified and operational CG limits.	x					
031 05 02 05	**Last-minute changes**						
LO	Complete a load and trim sheet for last-minute changes.	x					
031 05 03 01	**Repositioning of CG by shifting the load**						
LO	Calculate the mass to be moved over a given distance, or to/from given compartments, to establish a defined CG position.	x	x	x	x	x	
LO	Calculate the distance to move a given mass to establish a defined CG position.	x	x	x	x	x	
031 05 03 02	**Repositioning of CG by additional load or ballast**						
LO	Calculate the amount of additional load or ballast to be loaded at a given position or compartment to establish a defined CG position.	x	x	x	x	x	
LO	Calculate the loading position or compartment for a given amount of additional load or ballast to establish a defined CG position.	x	x	x	x	x	
031 06 00 00	**CARGO HANDLING**						
031 06 01 00	**Types of cargo (general aspects)**						
LO	Explain the basic idea of typical types of cargo, e.g. containerised cargo, palletised cargo, bulk cargo.	x	x	x	x	x	
031 06 02 00	**Floor-area load and running-load limitations in cargo compartments**						
LO	Calculate the required floor-contact area for a given load to avoid exceeding the maximum permissible floor load of a cargo compartment.	x	x	x	x	x	
LO	Calculate the maximum mass of a container with given floor-contact area to avoid exceeding the maximum permissible floor load of a cargo compartment.	x	x	x	x	x	
LO	Calculate the linear load distribution of a container to avoid exceeding the maximum permissible running load.	x	x	x	x	x	
031 06 03 00	**Securement of load**						

LO	Explain the reasons for having an adequate tie-down of loads.	x	x	x	x	x	
LO	Name the basic methods for securing loads.	x	x	x	x	x	

E. SUBJECT 032 — PERFORMANCE (AEROPLANE)

(1) For theoretical knowledge examination purposes:

'Climb angle' is assumed to be air mass-related.

'Flight-path angle' is assumed to be ground-related.

'Screen height for take-off' is the vertical distance between the take-off surface and the take-off flight path at the end of the take-off distance.

'Screen height for landing' is the vertical distance between the landing surface and the landing flight path from which the landing distance begins.

(2) For mass definitions, please refer to CHAPTER D (SUBJECT 031 — MASS AND BALANCE).

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
032 00 00 00	**PERFORMANCE — AEROPLANES**						
032 01 00 00	**GENERAL**						
032 01 01 00	**Performance legislation**						
032 01 01 01	**Airworthiness requirements according to CS-23 and CS-25**						
LO	Interpret the European Union airworthiness requirements according to CS-23 relating to aeroplane performance.	x	x				
LO	Interpret the European Union airworthiness requirements according to CS-25 relating to aeroplane performance.	x					
LO	Name the general differences between aeroplanes as certified according to CS-23 and CS-25.	x					
032 01 01 02	**Operational regulations**						

LO	Interpret the applicable operational requirements related to aeroplane performance.	x	x				
LO	Name and define the performance classes for commercial air transportation according to the applicable operational requirements.	x	x				
032 01 02 00	**General performance theory**						
032 01 02 01	**Stages of flight**						
LO	Describe the following stages of flight: take-off; climbing flight; level flight; descending flight; approach and landing.	x	x				
032 01 02 02	**Definitions, terms and concepts**						
LO	Define 'steady' flight.	x	x				
LO	Resolve the forces during steady climbing and descending flight.	x	x				
LO	Determine the opposing forces during horizontal steady flight.	x	x				
LO	Interpret the 'thrust/power required' and 'thrust/power available' curves.	x	x				
LO	Describe the meaning of 'excess thrust and power' using appropriate graphs.	x	x				
LO	Describe the effect of excess thrust and power on speed and/or climb performance.	x	x				
LO	Calculate the climb gradient from given thrust, drag and aeroplane mass.	x	x				
LO	Explain climb, level flight and descent performance in relation to the combination of thrust/power available and required.	x	x				
LO	Explain the difference between angle and gradient.	x	x				
LO	Define the terms 'climb angle' and 'climb gradient'.	x	x				
LO	Define the terms 'flight-path angle' and 'flight-path gradient'.	x	x				
LO	Define the terms 'descent angle' and 'descent gradient'.	x	x				

LO	Explain the difference between climb/descent angle and flight-path angle.	x	x				
LO	Define 'service' and 'absolute ceiling'.	x	x				
LO	Define the terms 'clearway (CWY)' and 'stopway (STW)' according to CS-Definitions.	x	x				
LO	Define the terms: Take-Off Run Available (TORA); Take-Off Distance Available (TODA); Accelerate-Stop Distance Available (ASDA); according to the applicable operational requirements.	x	x				
LO	Define 'screen height' and list its various values.	x	x				
LO	Define the terms 'range' and 'endurance'.	x	x				
LO	Define the aeroplane's 'Specific Fuel Consumption (SFC)'. Remark: Engine specific fuel consumption is covered in 021.	x	x				
LO	Define the aeroplane's 'Specific Range (SR)'.	x	x				
032 01 02 03	**Variables influencing performance**						
LO	Name and understand the following factors that affect aeroplane performance, particularly: temperature; air density; wind; aeroplane mass; aeroplane configuration; aeroplane anti-skid system status; aeroplane centre of gravity; aerodrome runway surface; aerodrome runway slope.	x	x				
032 02 00 00	**PERFORMANCE CLASS B — SINGLE-ENGINE AEROPLANES**						
032 02 01 00	**Definitions of speeds used**						

LO	Define the following speeds according to CS-23: stall speeds VS, VS0 and VS1; rotation speed VR; speed at 50 ft above the take-off surface level; reference speed landing VREF.	x	x				
032 02 02 00	**Effect of variables on single-engine aeroplane performance**						
LO	Explain the effect of the wind component on take-off and landing performance.	x	x				
LO	Determine the regulatory factors for take-off and landing according to the applicable operational requirements.	x	x				
LO	Explain the effects of temperature, wind and altitude on climb performance.	x	x				
LO	Explain the effects of altitude and temperature on cruise performance.	x	x				
LO	Explain the effects of mass, wind and speed on descent performance.	x	x				
032 02 03 00	**Take-off and landing**						
LO	Interpret the take-off and landing requirements according to the applicable operational requirements.	x	x				
LO	Define the following distances: take-off distance; landing distance; ground-roll distance; maximum allowed take-off mass; maximum allowed landing mass.	x	x				
LO	Explain the effect of flap-setting on the ground-roll distance.	x	x				
032 02 04 00	**Climb, cruise and descent**						
LO	Explain the effects of the different recommended power settings on range and endurance.	x	x				
LO	Explain the effects of wind and altitude on maximum endurance speed.	x	x				
032 02 05 00	**Use of aeroplane performance data**						

032 02 05 01	**Take-off**						
LO	Find the minimum or maximum wind component.	x	x				
LO	Find the take-off distance and ground-roll distance.	x	x				
LO	Find the maximum allowed take-off mass.	x	x				
LO	Find the take-off speed.	x	x				
032 02 05 02	**Climb**						
LO	Find the maximum rate-of-climb speed.	x	x				
LO	Find the time, distance and fuel to climb.	x	x				
LO	Find the rate of climb.	x	x				
032 02 05 03	**Cruise**						
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption.	x	x				
LO	Find range and endurance.	x	x				
LO	Find the difference between still air distance (NAM) and ground distance (NM).	x	x				
032 02 05 04	**Landing**						
LO	Find the minimum or maximum wind component.	x	x				
LO	Find the landing distance and ground-roll distance.	x	x				
032 03 00 00	**PERFORMANCE CLASS B — MULTI-ENGINE AEROPLANES**						
032 03 01 00	**Definitions of terms and speeds**						
LO	Define and explain the following terms: critical engine; speed for best angle of climb (VX); speed for best rate of climb (VY).	x	x				
LO	Explain the effect of the critical engine inoperative on the power required and the total drag.	x	x				
LO	Explain the effect of engine failure on controllability under given conditions.	x	x				
032 03 02 00	**Effect of variables on multi-engine aeroplane performance**						
032 03 02 01	**Take-off and landing**						
LO	Explain the effect of flap-setting on the ground-roll distance.	x	x				

LO	For both fixed and constant speed propellers, explain the effect of airspeed on thrust during the take-off run.	x	x				
LO	Explain the effect of pressure altitude on performance-limited take-off mass.	x	x				
LO	Explain the effect of runway conditions on the take-off distance.	x	x				
LO	Determine the regulation factors for take-off according to the applicable operational requirements.	x	x				
LO	Explain the percentage of accountability for headwind and tailwind components during take-off and landing calculations.	x	x				
LO	Interpret obstacle clearance at take-off.	x	x				
LO	Explain the effect of selected power settings, flap settings and aeroplane mass on the rate of climb.	x	x				
LO	Describe the effect of engine failure on take-off climb performance.	x	x				
LO	Explain the effect of brake release before take-off power is set on the take-off and accelerate-stop distance.	x	x				
032 03 02 02	**Climb, cruise and descent**						
LO	Explain the effect of CG on fuel consumption.	x	x				
LO	Explain the effect of mass on the speed for best angle and best rate of climb.	x	x				
LO	Explain the effect of mass on the speed for best angle and best rate of descent.	x	x				
LO	Explain the effect of temperature and altitude on fuel flow.	x	x				
LO	Explain the effect of wind on the maximum range speed and speed for maximum climb angle.	x	x				
LO	Explain the effect of mass, altitude, wind, speed and configuration on glide descent.	x	x				
LO	Describe the various cruise techniques.	x	x				
LO	Describe the effect of loss of engine power on climb and cruise performance.	x	x				
032 03 02 03	**Landing**						
LO	Explain the effect of runway conditions on the landing distance.	x	x				

LO	Determine the regulatory factors for landing according to the applicable operational requirements.	x	x					
032 03 03 00	**Use of aeroplane performance data**							
032 03 03 01	**Take-off**							
LO	Find take-off field-length data.	x	x					
LO	Calculate the field-length limited take-off mass.	x	x					
LO	Find the accelerate-go distance as well the accelerate-stop distance data.	x	x					
LO	Find the ground-roll and take-off distance.	x	x					
LO	Calculate the maximum effort take-off data.	x	x					
LO	Calculate all engine and critical engine-out take-off climb data.	x	x					
LO	Calculate obstacle clearance take-off climb data.	x	x					
032 03 03 02	**Climb**							
LO	Find rate of climb and climb gradient.	x	x					
LO	Calculate single engine service ceiling.	x	x					
LO	Calculate obstacle clearance climb data.	x	x					
032 03 03 03	**Cruise and descent**							
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption.	x	x					
LO	Calculate range and endurance data.	x	x					
032 03 03 04	**Landing**							
LO	Find landing field-length data.	x	x					
LO	Find landing climb data in the event of balked landing.	x	x					
LO	Find landing distance and ground-roll distance.	x	x					
LO	Find short-field landing distance and ground-roll distance.	x	x					
032 04 00 00	**PERFORMANCE CLASS A — AEROPLANES CERTIFIED ACCORDING TO CS-25 ONLY**							
032 04 01 00	**Take-off**							
LO	Explain the essential forces affecting the aeroplane during take-off.	x						

LO	State the effects of thrust-to-weight ratio and flap-setting on ground roll.	x					
032 04 01 01	**Definitions of terms used**						
LO	Define the terms 'Aircraft Classification Number (ACN)' and 'Pavement Classification Number (PCN)'.	x					
LO	Define and explain the following speeds in accordance with CS-25 or CS-Definitions: reference stall speed (VSR); reference stall speed in the landing configuration (VSR0); reference stall speed in a specific configuration (VSR1); 1-g stall speed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight (VS1g); minimum control speed with critical engine inoperative (VMC); minimum control speed on or near the ground (VMCG); minimum control speed at take-off climb (VMCA); engine failure speed (VEF); take-off decision speed (V1); rotation speed (VR); minimum take-off safety speed (V2MIN); minimum unstick speed (VMU); lift-off speed (VLOF); max brake energy speed (VMBE); max tyre speed (V Max Tyre); reference landing speed (VREF); minimum control speed, approach and landing (VMCL).	x					
LO	Explain the interdependence between of the above mentioned speeds if there is any.	x					

LO	Define the following distances in accordance with CS-25: take-off run with all engines operating and one engine inoperative; take-off distance with all engines operating and one engine inoperative; accelerate-stop distance with all engines operating and one engine inoperative.	x					
LO	Define the term 'Aeroplane-Specific Fuel Consumption (ASFC)'. Remark: Engine-specific fuel consumption is covered in subject 021.	x					
032 04 01 02	**Take-off distances**						
LO	Explain the effects of the following runway (RWY) variables on take-off distances: RWY slope; RWY surface conditions: dry, wet and contaminated; RWY elevation.	x					
LO	Explain the effects of the following aeroplane variables on take-off distances: aeroplane mass; take-off configuration; bleed-air configurations.	x					
LO	Explain the effects of the following meteorological variables on take-off distances: wind; temperature; pressure altitude.	x					
LO	Explain the influence of errors in rotation technique on take-off distance: early and late rotation; too high and too low rotation angle; too high and too low rotation rate.	x					
LO	Explain the take-off distances for specified conditions and configuration for all engines operating and one engine inoperative.	x					

LO	Explain the effect of using clearway on the take-off distance required.	x						
LO	Explain the influence of V1 and V2MIN on take-off distance.	x						
LO	Explain the time interval allowed for between engine failure and recognition when assessing the TOD.	x						
LO	Explain the effect of a miscalculation of V1 on the take-off distance required.	x						
032 04 01 03	**Accelerate-stop distance**							
LO	Explain the accelerate-stop distance for specified conditions and configuration for all engines operating and one engine inoperative.	x						
LO	Explain the effect of using a stopway on the accelerate-stop distance required.	x						
LO	Explain the effect of miscalculation of V1 on the accelerate-stop distance required.	x						
LO	Explain the effect of runway slope on the accelerate-stop distance.	x						
LO	Explain the additional time allowance for accelerate-stop distance determination and discuss the deceleration procedure.	x						
LO	Explain the use of brakes, anti-skid, use of reverse thrust, ground spoilers or lift dumpers, brake energy absorption limits, delayed temperature rise and tyre limitations.	x						
032 04 01 04	**Balanced field length concept**							
LO	Define the term 'balanced field length'.	x						
LO	Understand the relationship between take-off distance, accelerate-stop distance and V1 when using a balanced field.	x						
LO	Describe the applicability of a balanced field length.	x						
032 04 01 05	**Unbalanced field length concept**							
LO	Define the term 'unbalanced field length'.	x						
LO	Describe the applicability of an unbalanced field length.	x						
LO	Explain the effect of a stopway on the allowed take-off mass and appropriate V1 when using an unbalanced field.	x						

LO	Explain the effect of a clearway on the allowed take-off mass and appropriate V1 when using an unbalanced field.	x					
032 04 01 06	**Runway Length-Limited Take-Off Mass (RLTOM)**						
LO	Define RLTOM for balanced and unbalanced field length.	x					
032 04 01 07	**Take-off climb**						
LO	Define the segments of the actual take-off flight path.	x					
LO	Explain the difference between the flat-rated and non-flat-rated part in performance charts.	x					
LO	Determine the changes in the configuration, power, thrust and speed in the take-off flight-path segments.	x					
LO	Determine the differences in climb-gradient requirements for two, three and four-engine aeroplanes.	x					
LO	State the maximum bank angle when flying at V2.	x					
LO	Explain the effects of aeroplane and meteorological variables on the take-off climb.	x					
LO	Describe the influence of airspeed selection, acceleration and turns on the climb gradients, best rate-of-climb speed and best angle-of-climb speed.	x					
LO	Determine the climb-limited take-off mass.	x					
032 04 01 08	**Obstacle-limited take-off**						
LO	Describe the operational regulations for obstacle clearance in the net take-off flight path.	x					
LO	Define 'actual and net take-off flight path with one engine inoperative' in accordance with CS-25.	x					
LO	Determine the effects of aeroplane and meteorological variables on the determination of obstacle-limited take-off mass.	x					
LO	Determine the obstacle-limited take-off mass.	x					
032 04 01 09	**Performance-limited take-off mass**						
LO	Define performance-limited take-off mass.	x					
032 04 01 10	**Take-off performance on wet and contaminated runways**						
LO	Explain the differences between the take-off performance determination on a wet or contaminated runway and on a dry runway.	x					

032 04 01 11	**Use of reduced and derated thrust**						
LO	Explain the advantages and disadvantages of using reduced and derated thrust.	x					
LO	Explain the difference between reduced and derated thrust.	x					
LO	Explain when reduced and derated thrust may and may not be used.	x					
LO	Explain the effect of using reduced and derated thrust on take-off performance including take-off speeds, take-off distance, climb performance and obstacle clearance.	x					
LO	Explain the assumed temperature method for determining reduced thrust performance.	x					
032 04 01 12	**Take-off performance using different take-off flap settings**						
LO	Explain the advantages and disadvantages of using different take-off flap settings to optimise the performance-limited take-off mass.	x					
032 04 01 13	**Take-off performance using increased V2 speeds ('improved climb performance')**						
LO	Explain the advantages and disadvantages of using increased V2 speeds.	x					
LO	Explain under what circumstances this procedure can be used.	x					
032 04 01 14	**Brake-energy and tyre-speed limit**						
LO	Explain the effects on take-off performance of brake-energy and tyre-speed limits.	x					
LO	Explain under which conditions this becomes limiting.	x					
032 04 01 15	**Use of aeroplane flight data**						
LO	Determine the maximum masses that satisfy all the regulations for take-off from the aeroplane performance data sheets.	x					
LO	Determine the relevant speeds for specified conditions and configuration from the aeroplane performance data sheets.	x					
032 04 02 00	**Climb**						
032 04 02 01	**Climb techniques**						
LO	Explain the effect of climbing with constant IAS.	x					

LO	Explain the effect of climbing with constant Mach number.	x					
LO	Explain the correct sequence of climb speeds for jet transport aeroplanes.	x					
LO	Determine the effect on TAS when climbing in and above the troposphere at constant Mach number.	x					
032 04 02 02	**Influence of variables on climb performance**						
LO	Explain the effect of aeroplane mass on the rate of climb (ROC).	x					
LO	Explain the effect of meteorological variables on ROC.	x					
LO	Explain the effect of aeroplane acceleration during a climb with constant IAS or Mach number.	x					
LO	Explain the effect on the operational speed limit when climbing at constant IAS.	x					
032 04 02 03	**Use of aeroplane flight data**						
LO	Explain the term ‘cross over altitude’ which occurs during the climb speed schedule (IAS–Mach number).	x					
LO	Calculate the time to climb.	x					
032 04 03 00	**Cruise**						
032 04 03 01	**Cruise techniques**						
LO	Define the cruise procedures ‘maximum endurance’ and ‘maximum range’.	x					
032 04 03 02	**Maximum endurance**						
LO	Explain fuel flow in relation to TAS and thrust.	x					
LO	Find the speed for maximum endurance.	x					
032 04 03 03	**Maximum range**						
LO	Define the term ‘maximum range’.	x					
032 04 03 04	**Long-range cruise**						
LO	Define the term ‘long-range cruise’.	x					
LO	Explain differences between flying the speed for long range and maximum range with regard to fuel-flow and speed stability.	x					
032 04 03 05	**Influence of variables on cruise performance**						
LO	Explain the effect and CG position and actual mass of aircraft on range and endurance.	x					

LO	Explain the effect of altitude on range and endurance.	x					
LO	Explain the effect of meteorological variables on range and endurance.	x					
032 04 03 06	**Cruise altitudes**						
LO	Define the term 'optimum altitude'.	x					
LO	Explain the factors which affect the choice of optimum altitude.	x					
LO	Explain the factors which might affect or limit the maximum operating altitude.	x					
LO	Explain the necessity for step climbs.	x					
LO	Describe the buffet onset boundary (BOB).	x					
LO	Analyse the influence of bank angle, mass and 1.3G buffet onset factor on a step climb.	x					
032 04 03 07	**Cost Index (CI)**						
LO	Define the term 'cost index'.	x					
LO	Understand the reason for economical cruise speed.	x					
032 04 03 08	**Use of aeroplane flight data**						
LO	Determine the all-engines operating power settings and speeds from the aeroplane performance data sheets for: maximum range; maximum endurance; high-speed and normal cruise; high and low-speed buffet (speed/Mach number only).	x					
LO	Determine the selection of cruise technique considering cost indexing and passenger requirements against company requirements.	x					
LO	Determine the fuel consumption from the aeroplane performance data sheets for various cruise configurations, holding, approach and transit to an alternate in normal conditions and after an engine failure.	x					
032 04 04 00	**En route one engine inoperative**						
032 04 04 01	**Drift down**						

LO	Describe the determination of en route flight path data with one engine inoperative in accordance with CS 25.123.	x					
LO	Determine the minimum obstacle-clearance height prescribed in the applicable operational requirements.	x					
LO	Define the speed during drift down.	x					
LO	Explain the influence of deceleration on the drift-down profiles.	x					
032 04 04 02	**Influence of variables on the en route one engine inoperative performance**						
LO	Identify the factors which affect the en route net flight path.	x					
032 04 04 03	Use of aeroplane flight data						
LO	Find one-engine-out service ceiling, range and endurance from given engine inoperative charts.	x					
LO	Find the maximum continuous power/thrust settings from given engine inoperative charts.	x					
032 04 05 00	**Descent**						
032 04 05 01	**Descent techniques**						
LO	Explain the effect of descending at constant Mach number.	x					
LO	Explain the effect of descending at with constant IAS.	x					
LO	Explain the correct sequence of descent speeds for jet transport aeroplanes.	x					
LO	Determine the effect on TAS when descending in and above the troposphere at constant Mach number.	x					
LO	Describe the following limiting speeds for descent: maximum operating speed (VMO); maximum Mach number (MMO).	x					
LO	Explain the effect of a descent at constant Mach number on the margin to low and high-speed buffet.	x					
032 04 05 02	**Influence of variables on descent performance**						
LO	Explain the influence of mass, configuration and altitude on rate of descent and glide angle.	x					
032 04 05 03	**Use of aeroplane flight data**						

LO	Determine the following information for all-engines operating and one engine inoperative from the aeroplane performance data sheets: descent rates; time and distance for descent; fuel used during descent.	x					
032 04 06 00	**Approach and landing**						
032 04 06 01	**Approach requirements**						
LO	Describe the CS-25 requirements for the approach climb.	x					
LO	Describe the CS-25 requirements for the landing climb.	x					
LO	Explain the effect of temperature and pressure altitude on approach and landing-climb performance.	x					
032 04 06 02	**Landing field-length requirement**						
LO	Describe the landing distance determined according to CS 25.125 ('demonstrated' landing distance).	x					
LO	Recall the landing field-length requirements for dry, wet and contaminated runways in the applicable operational requirements.	x					
LO	Define the 'Landing Distance Available (LDA)'.	x					
032 04 06 03	**Influence of variables on landing performance**						
LO	Explain the effect of runway slope, surface conditions and wind on the maximum landing mass for a given runway length in accordance with the applicable operational requirements.	x					
LO	Explain the effect on landing distance and maximum allowable landing mass of the following devices affecting: deceleration; reverse; anti-skid; ground spoilers or lift dumpers; autobrakes.	x					
LO	Explain the effect of temperature and pressure altitude on the maximum landing mass for a given runway length.	x					

LO	Explain the effect of hydroplaning on landing distance required.	x					
032 04 06 04	**Quick turnaround limit**						
LO	Define the 'quick turnaround limits' and explain their purpose.	x					
032 04 06 05	**Use of aeroplane flight data**						
LO	Determine the field length required for landing with a given landing mass from the aeroplane performance data sheets in accordance with the applicable operational requirements.	x					
LO	Determine the landing and approach climb-limited landing mass from the aeroplane performance data sheets.	x					
LO	Determine the landing-field length-limited landing mass from the aeroplane performance data sheets.	x					
LO	Find the structural-limited landing mass from the aeroplane performance data sheets.	x					
LO	Calculate the maximum allowable landing mass as the lowest of: approach climb and landing climb-limited landing mass; landing-field length-limited landing mass; structural-limited landing mass.	x					
LO	Determine the maximum quick turnaround mass and time under given conditions from the aeroplane performance data sheets.	x					
LO	Determine the limiting landing mass in respect of PCN.	x					

F. SUBJECT 033 — FLIGHT PLANNING AND MONITORING

(1) For mass definitions, please refer to Chapter D.

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
033 00 00 00	**FLIGHT PLANNING AND MONITORING**						

033 01 00 00	**FLIGHT PLANNING FOR VFR FLIGHTS** **Remark: Using training route manual VFR charts or the European Central Question Bank (ECQB) annexes.**						
033 01 01 00	**VFR navigation plan**						
033 01 01 01	**Routes, airfields, heights and altitudes from VFR charts**						
LO	Select routes and altitudes taking the following criteria into account: classification of airspace; controlled airspace; uncontrolled airspace; restricted areas; minimum safe altitude; VFR semicircular rules; conspicuous points; navigation aids.	x	x	x	x	x	
LO	Calculate the minimum pressure or true altitude from minimum grid-area altitude using OAT and QNH.	x	x	x	x	x	
LO	Calculate the vertical and/or horizontal distance and time to climb to a given level or altitude.	x	x	x	x	x	
LO	Calculate the vertical and/or horizontal distance and time to descend from a given level or altitude.	x	x	x	x	x	
LO	Find the frequency and/or identifiers of radio-navigation aids from charts.	x	x	x	x	x	
033 01 01 02	**Courses and distances from VFR charts**						
LO	Choose waypoints in accordance with specified criteria.	x	x	x	x	x	
LO	Calculate, or obtain from the chart, courses and distances.	x	x	x	x	x	
LO	Find the highest obstacle within a given distance on either side of the course.	x	x	x	x	x	
LO	Find the following data from the chart and transfer them to the navigation plan: waypoints and/or turning points;	x	x	x	x	x	

	distances; true/magnetic courses.						
033 01 01 03	**Aerodrome charts and aerodrome directory**						
LO	Explain the reasons for studying the visual departure procedures and the available approach procedures.	x	x	x	x	x	
LO	Find all visual procedures which can be expected at the departure, destination and alternate airfields.	x	x	x	x	x	
LO	Find the following data from the charts or directory: aerodrome regulations and opening hours; terrain high points and man-made structures; altitudes; courses and radials; helipads (for helicopters only); any other relevant information.	x	x	x	x	x	
033 01 01 04	**Communications and radio-navigation planning data**						
LO	Find the communication frequencies and call signs for the following: control agencies and service facilities; Flight Information Services (FIS); weather information stations; Automatic Terminal Information Service (ATIS).	x	x	x	x	x	
LO	Find the frequency and/or identifier of the appropriate radio-navigation aids.	x	x	x	x	x	
033 01 01 05	**Completion of navigation plan**						
LO	Complete the navigation plan with the courses and distances as taken from charts.	x	x	x	x	x	
LO	Find the departure and arrival routes.	x	x	x	x	x	
LO	Determine the position of Top of Climb (ToC) and Top of Descend (ToD) from given appropriate data.	x	x	x	x	x	
LO	Determine variation and calculate magnetic courses.	x	x	x	x	x	

LO	Calculate the True Airspeed (TAS) from given aircraft performance data, altitude and Outside-Air Temperature (OAT).	x	x	x	x	x	
LO	Calculate Wind Correction Angles (WCA) and Drift and Ground Speeds (GS).	x	x	x	x	x	
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields.	x	x	x	x	x	
033 02 00 00	**FLIGHT PLANNING FOR IFR FLIGHTS** **Remark: Using training route manual IFR charts or the ECQB annexes.**						
033 02 01 00	**IFR navigation plan**						
033 02 01 01	**Airways and routes**						
LO	Select the preferred airway(s) or route(s) considering: altitudes and flight levels; standard routes; ATC restrictions; shortest distance; obstacles; any other relevant data.	x		x			x
033 02 01 02	**Courses and distances from en route charts**						
LO	Determine courses and distances.	x		x			x
LO	Determine bearings and distances of waypoints from radio-navigation aids.	x		x			x
033 02 01 03	**Altitudes**						
LO	Define the following minimum altitudes: Minimum En route Altitude (MEA); Minimum Obstacle-Clearance Altitude (MOCA); Minimum Off-Route Altitude (MORA); Grid Minimum Off-Route Altitude (Grid MORA); Maximum Authorised Altitude (MAA); Minimum Crossing Altitude (MCA); Minimum Holding Altitude (MHA).	x		x			x

LO	Extract the following minimum altitudes from the chart(s): Minimum En route Altitude (MEA); Minimum Obstacle-Clearance Altitude (MOCA); Minimum Off-Route Altitude (MORA); Grid Minimum Off-Route altitude (Grid MORA); Maximum Authorised Altitude (MAA); Minimum Crossing Altitude (MCA); Minimum Holding Altitude (MHA).	x		x			x
033 02 01 04	**Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs)**						
LO	Explain the reasons for studying SID and STAR charts.	x		x			x
LO	State the reasons why SID and STAR charts show procedures only in a pictorial presentation style which is not to scale.	x		x			x
LO	Interpret all data and information represented on SID and STAR charts, particularly: routings, distances, courses, radials, altitudes/levels, frequencies, restrictions.	x		x			x
LO	Identify SIDs and STARs which might be relevant to a planned flight.	x		x			x
033 02 01 05	**Instrument-approach charts**						
LO	State the reasons for being familiar with instrument-approach procedures and appropriate data for departure, destination and alternate airfields.	x		x			x
LO	Select instrument-approach procedures appropriate for departure, destination and alternate airfields.	x		x			x

LO	Interpret all procedures, data and information represented on instrument-approach charts, particularly: courses and radials; distances; altitudes/levels/heights; restrictions; obstructions; frequencies; speeds and times; Decision Altitudes/Heights (DA/H); (DA/H) and Minimum Descent Altitudes/Heights (MDA/H); visibility and Runway Visual Ranges (RVR); approach light systems.	x		x			x
033 02 01 06	**Communications and radio-navigation planning data**						
LO	Find the communication frequencies and call signs for the following: control agencies and service facilities; Flight Information Services (FIS); weather information stations; Automatic Terminal Information Service (ATIS).	x		x			x
LO	Find the frequency and/or identifiers of radio-navigation aids.	x		x			x
033 02 01 07	**Completion of navigation plan**						
LO	Complete the navigation plan with the courses, distances and frequencies taken from charts.	x		x			x
LO	Find the Standard Instrument Departure and Arrival Routes to be flown and/or to be expected.	x		x			x
LO	Determine the position of Top of Climb (ToC) and Top of Descent (ToD) from given appropriate data.	x		x			x
LO	Determine variation and calculate magnetic/true courses.	x		x			x

LO	Calculate True Airspeed (TAS) from given aircraft performance data, altitude and Outside-Air Temperature (OAT).	x		x			x
LO	Calculate Wind Correction Angles (WCA) / Drift and Ground Speeds (GS).	x		x			x
LO	Determine all relevant altitudes/levels, and particularly MEA, MOCA, MORA, MAA, MCA, MRA and MSA.	x		x			x
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields.	x		x			x
033 03 00 00	**FUEL PLANNING**						
033 03 01 00	**General**						
LO	Convert to volume, mass and density given in different units which are commonly used in aviation.	x	x	x	x	x	x
LO	Determine relevant data from the Flight Manual, such as fuel capacity, fuel flow/consumption at different power/ thrust settings, altitudes and atmospheric conditions.	x	x	x	x	x	x
LO	Calculate the attainable flight time/range from given fuel flow/ consumption and available amount of fuel.	x	x	x	x	x	x
LO	Calculate the required fuel from given fuel flow/consumption and required time/range to be flown.	x	x	x	x	x	x
LO	Calculate the required fuel for a VFR flight from given expected meteorological conditions and expected delays under defined conditions.	x	x	x	x	x	x
LO	Calculate the required fuel for an IFR flight from given expected meteorological conditions and expected delays under defined conditions.	x		x			x
033 03 02 00	**Pre-flight fuel planning for commercial flights**						
033 03 02 01	**Taxiing fuel**						
LO	Determine the fuel required for engine start and taxiing by consulting the fuel-usage tables and/or graphs from the Flight Manual taking into account all the relevant conditions.	x	x	x	x	x	
033 03 02 02	**Trip fuel**						
LO	Define 'trip fuel' and name the segments of flight for which the trip fuel is relevant.	x	x	x	x	x	

LO	Determine the trip fuel for the flight by using data from the navigation plan and fuel tables and/or graphs from the Flight Manual.	x	x	x	x	x	
033 03 02 03	**Reserve fuel and its components**						
	Contingency fuel						
LO	Explain the reasons for having contingency fuel.	x	x	x	x	x	
LO	State and explain the requirements for contingency fuel according to the applicable operational requirements.	x	x				
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements.	x	x				
LO	State and explain the requirements for contingency fuel according to the applicable operational requirements.			x	x	x	
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for IFR flights.			x			
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for VFR flights in a hostile environment.			x	x	x	
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for VFR flights in a non-hostile environment.			x	x	x	
	Alternate fuel						
LO	Explain the reasons and regulations for having alternate fuel and name the segments of flight for which the fuel is relevant.	x	x	x	x	x	
LO	Calculate the alternate fuel in accordance with the applicable operational requirements and relevant data from the navigation plan and the Flight Manual.	x	x				
LO	Calculate the alternate fuel in accordance with the applicable operational requirements and relevant data from the navigation plan and the Flight Manual.			x	x	x	
	Final reserve fuel						
LO	Explain the reasons and regulations for having final reserve fuel.	x	x	x	x	x	

LO	Calculate the final reserve fuel for an aeroplane with piston engines and for an aeroplane with turbine-power units in accordance with the applicable operational requirements and by using relevant data from the Flight Manual.	x	x				
LO	Calculate the final reserve fuel for a VFR flight (by day with reference to visual landmarks) in accordance with the applicable operational requirements and by using relevant data from the Flight Manual.			x	x	x	
LO	Calculate the final reserve fuel for a IFR flight in accordance with the applicable operational requirements and by using relevant data from the Flight Manual.			x			
	Additional fuel						
LO	Explain the reasons and regulations for having additional fuel.	x	x	x	x	x	
LO	Calculate the additional fuel for an IFR flight without a destination alternate in accordance with the applicable operational requirements for an isolated aerodrome.	x					
LO	Calculate the additional fuel for a flight to an isolated heliport in accordance with the applicable operational requirements.			x	x	x	
033 03 02 04	**Extra fuel**						
LO	Explain the reasons and regulations for having extra fuel in accordance with the applicable operational requirements.	x	x				
LO	Explain the reasons and regulations for having extra fuel in accordance with the applicable operational requirements.			x	x	x	
LO	Calculate the possible extra fuel under given conditions.	x	x	x	x	x	
033 03 02 05	**Calculation of total fuel and completion of the fuel section of the navigation plan (fuel log)**						
LO	Calculate the total fuel required for a flight.	x	x	x	x	x	
LO	Complete the fuel log.	x	x	x	x	x	
033 03 03 00	**Specific fuel-calculation procedures**						
033 03 03 01	**Decision-point procedure**						

LO	Explain the reasons and regulations for the decision-point procedure as stated in the applicable operational requirements.	x					
LO	Calculate the contingency fuel and trip fuel required in accordance with the decision-point procedure.	x					
033 03 03 02	**Isolated-aerodrome procedure**						
LO	Explain the basic procedures for an isolated aerodrome as stated in the applicable operational requirements.	x					
LO	Calculate the additional fuel for aeroplanes with reciprocating engines according to the isolated-aerodrome procedures.	x					
LO	Calculate the additional fuel for aeroplanes with turbine engines according to the isolated-aerodrome procedures.	x					
033 03 03 03	**Predetermined point procedure**						
LO	Explain the basic idea of the predetermined-point procedure as stated in the applicable operational requirements.	x					
LO	Calculate the additional fuel for aeroplanes with reciprocating engines according to the predetermined-point procedure.	x					
LO	Calculate the additional fuel for aeroplanes with turbine engines according to the predetermined-point procedure.	x					
033 03 03 04	**Fuel-tankering**						
LO	Explain the basic idea of fuel-tankering procedures.	x					
LO	Explain that there is an optimum fuel quantity to be tankered (as a function of the fuel-price ratio between departure and destination airports and air distance to fly).	x					
LO	Calculate tankered fuel by using given appropriate graphs, tables and/or data.	x					
033 03 03 05	**Isolated-heliport procedure**						
LO	Explain the basic idea of the isolated-heliport procedures as stated in the applicable operational requirements.			x	x		
LO	Calculate the additional fuel according to the isolated-heliport procedures as stated in the			x			

	applicable operational requirements for flying IFR.						
LO	Calculate the additional fuel according to the isolated-heliport procedures as stated in the applicable operational requirements for flying VFR and navigating by means other than by reference to visual landmarks.			x	x		
033 04 00 00	**PRE-FLIGHT PREPARATION**						
033 04 01 00	**NOTAM briefing**						
033 04 01 01	**Ground facilities and services**						
LO	Check that the ground facilities and services required for the planned flight are available and adequate.	x	x	x	x	x	x
033 04 01 02	**Departure, destination and alternate aerodromes**						
LO	Find and analyse the latest state at the departure, destination and alternate aerodromes, in particular for: opening hours; Work in Progress (WIP); special procedures due to Work in Progress (WIP); obstructions; changes of frequencies for communications, navigation aids and facilities.	x	x	x	x	x	x
033 04 01 03	**Airway routings and airspace structure**						
LO	Find and analyse the latest en route state for: airway(s) or route(s); restricted, danger and prohibited areas; changes of frequencies for communications, navigation aids and facilities.	x	x	x	x	x	x
033 04 02 00	**Meteorological briefing**						
033 04 02 01	**Extraction and analysis of relevant data from meteorological documents** **Remark: This item is taught and examined in subject 050.**						
033 04 02 02	**Update of navigation plan using the latest meteorological information**						

LO	Confirm the optimum altitude/FL from given wind, temperature and aircraft data.	x	x	x	x	x	x
LO	Confirm true altitudes from given atmospheric data to ensure that statutory minimum clearance is attained.	x	x	x	x	x	x
LO	Confirm magnetic headings and ground speeds.	x	x	x	x	x	x
LO	Confirm the individual leg times and the total time en route.	x	x	x	x	x	x
LO	Confirm the total time en route for the trip to the destination.	x	x	x	x	x	x
LO	Confirm the total time from destination to the alternate airfield.	x	x	x	x	x	x
033 04 02 03	Update of mass and balance Remark: This item is taught and examined in subject 031.						
033 04 02 04	Update of performance data Remark: This item is taught and examined in subject 032 for aeroplanes and subject 034 for helicopters.						
033 04 02 05	Update of fuel log						
LO	Calculate the revised fuel data in accordance with the changed conditions.	x	x	x	x	x	x
033 04 03 00	Point of Equal Time (PET) and Point of Safe Return (PSR)						
033 04 03 01	Point of Equal Time (PET)						
LO	Define 'PET'.	x		x	x		
LO	Explain the basic idea of determination of PET.	x		x	x		
LO	Calculate the position of a PET and the ETA at the PET from given relevant data.	x		x	x		
033 04 03 02	Point of Safe Return (PSR)						
LO	Define 'PSR'.	x		x	x		
LO	Explain the basic idea of determination of PSR.	x		x	x		
LO	Calculate the position of a PSR and the ETA at the PSR from given relevant data.	x		x	x		
033 05 00 00	ICAO FLIGHT PLAN (ATS Flight Plan)						
033 05 01 00	Individual Flight Plan						

033 05 01 01	Format of Flight Plan						
LO	State the reasons for a fixed format of an ICAO ATS Flight Plan (FPL).	x	x	x	x	x	x
LO	Determine the correct entries to complete an FPL plus decode and interpret the entries in a completed FPL, particularly for the following: aircraft identification (Item 7); flight rules and type of flight (Item 8); number and type of aircraft and wake-turbulence category (Item 9); equipment (Item 10); departure aerodrome and time (Item 13); route (Item 15); destination aerodrome, total estimated elapsed time and alternate aerodrome (Item 16); other information (Item 18); supplementary information (Item 19).	x	x	x	x	x	x
033 05 01 02	**Completion of an ATS Flight Plan (FPL)**						
LO	Complete the FPL by using the information from the following: navigation plan; fuel plan; operator's records for basic aircraft information.	x	x	x	x	x	x
033 05 02 00	**Repetitive Flight Plan**						
LO	Explain the difference between an Individual Flight Plan (FPL) and a Repetitive Flight Plan (RPL).	x		x	x		
LO	Explain the basic idea of an RPL and state the general requirements for its use.	x		x	x		
033 05 03 00	**Submission of an ATS Flight Plan (FPL)** **Remark: This item is taught and examined in subject 010.**						

033 06 00 00	**FLIGHT MONITORING AND IN-FLIGHT REPLANNING**						
033 06 01 00	**Flight monitoring**						
033 06 01 01	**Monitoring of track and time**						
LO	Assess deviations from the planned course, headings (by maintaining desired courses) and times.	x	x	x	x	x	x
LO	State the reasons for possible deviations.	x	x	x	x	x	x
LO	Calculate the ground speed by using actual in-flight parameters.	x	x	x	x	x	x
LO	Calculate the expected leg times by using actual flight parameters.	x	x	x	x	x	x
033 06 01 02	**In-flight fuel management**						
LO	Explain why fuel checks must be carried out in flight at regular intervals and why relevant fuel data must be recorded.	x	x	x	x	x	x
LO	Assess deviations of actual fuel consumption from planned consumption.	x	x	x	x	x	x
LO	State the reasons for possible deviations.	x	x	x	x	x	x
LO	Calculate the fuel quantities used, fuel consumption and fuel remaining at navigation checkpoints /waypoints.	x	x	x	x	x	x
LO	Compare the actual with the planned fuel consumption by means of calculation or flight-progress chart.	x	x	x	x	x	x
LO	Assess the remaining range and endurance by means of calculation or flight-progress chart.	x	x	x	x	x	x
033 06 01 03	**Monitoring of primary flight parameters**						
	Explain the methodology for monitoring of primary flight parameters during the application of the procedures requiring a high flight crew workload within a short time frame (including monitoring of primary flight parameters, in particular pitch, thrust and speed).	x	x	x	x	x	x
033 06 02 00	**In-flight replanning in case of deviation from planned data**						
LO	Justify that the commander is responsible that even in case of diversion the remaining fuel is not less than the fuel required to proceed to	x	x	x	x	x	

	an aerodrome where a safe landing can be made, with final reserve fuel remaining.						
LO	Perform in-flight updates, if necessary, based on the results of in-flight monitoring, specifically by: selecting a new destination/ alternate aerodrome; adjusting flight parameters and power settings.	x	x	x	x	x	
LO	Explain why, in the case of an in-flight update, the commander has to check the following: the suitability of the new destination and/or alternate aerodrome; meteorological conditions on revised routing and at revised destination and/or alternate aerodrome; the aircraft must be able to land with the prescribed final reserve fuel.	x	x	x	x	x	
LO	Assess the revised destination/ alternate aerodrome landing mass from given latest data.	x	x	x	x	x	

G. SUBJECT 034 — PERFORMANCE (HELICOPTER)

(1) For mass definitions, please refer to Chapter D.

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
034 00 00 00	**PERFORMANCE — HELICOPTER**						
034 01 00 00	**GENERAL**						
034 01 01 00	**Performance legislation**						
034 01 01 01	**Airworthiness requirements**						
LO	Interpret the airworthiness requirements in CS-27 and CS-29 as related to helicopter performance.			x	x	x	

LO	Name the general differences between helicopters as certified according to CS-27 and CS-29.			x	x	x	
034 01 01 02	**Operational regulations**						
LO	State the responsibility to comply with the operational procedures.			x	x	x	
LO	Interpret the European Union regulation on operations.			x	x	x	
LO	Use and interpret diagrams and tables associated with CAT A and CAT B procedures in order to select and develop class 1, 2 and 3 performance profiles according to available heliport size and location (surface or elevated).			x	x		
LO	Use and interpret diagrams and tables associated with CAT B procedures in order to select and develop class-3 single-engine helicopter performance profiles according to available heliport size and location (surface or elevated).					x	
LO	Interpret the charts showing minimum clearances associated with Category A & B procedures.			x	x		
034 01 02 00	**General performance theory**						
034 01 02 01	**Stages of flight**						
LO	Explain the following stages of flight: take-off, climb, level flight, descent, approach and landing.			x	x	x	
LO	Describe the necessity for different take-off and landing procedures.			x	x	x	
034 01 02 02	**Definitions and terms**						

LO	Define the following terms: Category A; Category B; Performance Class 1, 2 and 3; congested area; elevated heliport; helideck; heliport; hostile environment; maximum approved passenger seating configuration; non-hostile environment; obstacle; rotor Radius (R); take-off mass; Touchdown and Lift-Off Area (TLOF); safe forced landing; speed for best rate of climb (Vy); never exceed speed (VNE); velocity landing gear extended (VLE); velocity landing gear operation (VLO); cruising speed and maximum cruising speed.			x	x	x	

LO	Define the following terms: reported headwind component; Take-off Decision Point (TDP); Defined Point After Take-Off (DPATO) ; Take-Off Distance Required (TODR); Take-Off Distance Available (TODA); Distance Required (DR); Rejected Take-Off Distance Required (RTODR); Rotation Point (RP); Committal Point (CP); Defined Point Before Landing (DPBL); Landing Decision Point (LDP); Landing Distance Available (LDA); Landing Distance Required (LDR); Take-off safety speed (V1); Take-off safety speed for Cat A rotorcraft (VTOSS)(V2).			x	x		
LO	Understand the meaning and significance of the acronyms AEO and OEI.			x	x		
LO	Define the terms ‘climb angle’ and ‘climb gradient’.			x	x		
LO	Define the terms ‘flight-path angle’ and ‘flight-path gradient’.			x	x		
LO	Define ‘VmaxRange’ (speed for maximum range) and VmaxEnd (speed for maximum endurance).			x	x	x	
LO	Define and calculate the gradient by using power, wind and helicopter mass.			x	x		
LO	Explain the terms ‘operational ceiling’ and ‘absolute ceiling’.			x	x	x	
LO	Explain the term ‘service ceiling OEI’.			x	x		
LO	Understand the difference between Hovering In Ground Effect (HIGE) and Hovering out of Ground Effect (HOGE).			x	x	x	
034 01 02 03	**Power required/power available curves**						
LO	Understand and interpret the graph power required/power available versus TAS.			x	x	x	

034 01 02 04	**Critical height-velocity graphs**						
LO	Understand and interpret the critical height-velocity graphs.			x	x	x	
034 01 02 05	**Influencing variables on performance**						
LO	Explain how the following factors effect helicopter performance: pressure altitude; humidity; temperature; wind; helicopter mass; helicopter configuration; helicopter CG.			x	x	x	
034 02 00 00	**PERFORMANCE CLASS 3 — SINGLE-ENGINE HELICOPTERS ONLY**						
034 02 01 00	**Effect of variables on single-engine helicopter performance**						
LO	Determine wind component, altitude and temperature for hovering, take-off and landing.			x	x	x	
LO	Explain that operations are only from/to heliports and over such routes, areas and diversions contained in a non-hostile environment where a safe forced landing can be carried out. (Consider the exception: Operations may be conducted in a hostile environment when approved).			x	x	x	
LO	Explain the effect of temperature, wind and altitude on climb, cruise and descent performance.			x	x	x	
034 02 02 00	**Take-off and landing (including hover)**						
LO	Explain the take-off and landing requirements.			x	x	x	
LO	Explain the maximum allowed take-off and landing mass.			x	x	x	
LO	Explain that mass has to be restricted to HIGE.			x	x	x	
LO	Explain that if HIGE is unlikely to be achieved, then mass must be restricted to HOGE.			x	x	x	
034 02 03 00	**Climb, cruise and descent**						

LO	State that the helicopter must be capable of flying its intended track without flying below the appropriate minimum flight altitude and be able to perform a safe forced landing.			x	x	x	
LO	Explain the effect of altitude on the maximum endurance speed.			x	x	x	
034 02 04 00	**Use of helicopter performance data**						
034 02 04 01	**Take-off (including hover)**						
LO	Find the maximum wind component.			x	x	x	
LO	Find the maximum allowed take-off mass for certain conditions.			x	x	x	
LO	Find the critical height-velocity parameters.			x	x	x	
034 02 04 02	**Climb**						
LO	Find the time, distance and fuel to climb for certain conditions.			x	x	x	
LO	Find the rate of climb under given conditions and the best rate-of-climb speed VY.			x	x	x	
034 02 04 03	**Cruise**						
LO	Find the cruising speed and fuel consumption for certain conditions.			x	x	x	
LO	Calculate the range and endurance under given conditions.			x	x	x	
034 02 04 04	**Landing (including hover)**						
LO	Find the maximum wind component.			x	x	x	
LO	Find the maximum allowed landing mass for certain conditions.			x	x	x	
LO	Find the critical height-velocity parameters.			x	x	x	
034 03 00 00	**PERFORMANCE CLASS 2**						
	General remark: The LOs for Performance Class 2 are principally identical with those of Performance Class 1. (See 034 04 00 00) Additional LOs are shown below.						
034 03 01 00	**Operations without an assured safe forced landing capability**						
LO	State the responsibility of the operator in order to assure a safe forced landing.			x	x		

034 03 02 00	**Take-off**						
LO	State the climb and other requirements for take-off.			x	x		
034 03 03 00	**Take-off Flight Path**						
LO	State the height above the take-off surface at which at least the requirements for the take-off flight path for Performance Class 1 are to be met.			x	x		
034 03 04 00	**Landing**						
LO	State the requirements for the climb capability for OEI.			x	x		
LO	State the options for a Performance Class 2 operation in case of critical power-unit failure at any point in the approach path.			x	x		
LO	State the limitations for operations to/from a helideck.			x	x		
034 04 00 00	**PERFORMANCE CLASS 1 — HELICOPTERS CERTIFICATED ACCORDING TO CS-29 ONLY**						
034 04 01 00	**Take-off**						
034 04 01 01	**Take-off distances**						
LO	Explain the effects of the following variables on the flight path and take-off distances: take-off with HIGE or HOGE; take-off procedure; obstacle clearances both laterally and vertically; take-off from non-elevated heliports; take-off from elevated heliports or helidecks; take-off from a Touchdown and Lift-Off Area (TLOF).			x	x		
LO	Explain the effects of the following variables on take-off distances: mass; take-off configuration; bleed-air configurations.			x	x		

LO	Explain the effects of the following meteorological variables on take-off distances: wind; temperature; pressure altitude.			x	x		
LO	Explain the take-off distances for specified conditions and configuration for AEO and OEI.			x	x		
LO	Explain the effect of obstacles on the take-off distance required.			x	x		
LO	Explain the influence of V1 and VTOSS speeds on the take-off distance.			x	x		
LO	State the assumed reaction time between engine failure and recognition.			x	x		
LO	Explain the effect of calculation of TDP and V1 on the take-off distance required.			x	x		
LO	Explain that the flight must be carried out visually up to TDP.			x	x		
034 04 01 02	**Rejected take-off distance required**						
LO	Explain the rejected take-off distance required for specified conditions and configuration for AEO and OEI.			x	x		
LO	Explain the effect of calculation of V1 on the rejected take-off distance required.			x	x		
LO	Explain the time-to-decide allowance (decision time) and deceleration procedure.			x	x		
034 04 01 03	**Landing distance from TDP with V1 to a complete stop on the ground**						
LO	Understand the relationship of take-off distance and landing distance from TDP with V1 to a complete ground stop.			x	x		
034 04 01 04	**Take-off climb**						
LO	Define the segments of the take-off flight path.			x	x		
LO	Explain the effect of changes in the configuration on power and speed in the segments.			x	x		
LO	Explain the climb-gradient requirements for OEI.			x	x		
LO	State the minimum altitude over the take-off path when flying at V1 to VTOSS.			x	x		

LO	Describe the influence of airspeed selection, acceleration and turns on the climb gradient and best rate-of-climb speed.			x	x		
034 04 01 05	**Obstacle-limited take-off**						
LO	Describe the operational regulations for obstacle clearance of the take-off flight path in the departure sector with OEI.			x	x		
034 04 01 06	**Use of helicopter flight data**						
LO	Determine from the helicopter performance data sheets the maximum masses that satisfy all the regulations for take-off.			x	x		
034 04 02 00	**Climb**						
034 04 02 01	**Climb techniques**						
LO	Explain the effect of climbing with best rate-of-climb speed (VY).			x	x		
LO	Explain the influence of altitude on VY.			x	x		
034 04 02 02	**Use of helicopter flight data**						
LO	Find the rate of climb and calculate the time to climb to a given altitude.			x	x		
034 04 03 00	**Cruise**						
034 04 03 01	**Cruise techniques**						
LO	Explain the cruise procedures for ‘maximum endurance’ and ‘maximum range’.			x	x		
034 04 03 02	**Maximum endurance**						
LO	Explain fuel flow in relation to TAS.			x	x		
LO	Explain the speed for maximum endurance.			x	x		
034 04 03 03	**Maximum range**						
LO	Explain the speed for maximum range.			x	x		
034 04 03 04	**Maximum cruise**						
LO	Explain the speed for maximum cruise.			x	x		
034 04 03 05	**Cruise altitudes**						
LO	Explain the factors which might affect or limit the operating altitude.			x	x		
LO	Understand the relation between power setting, fuel consumption, cruising speed and altitude.			x	x		
034 04 03 06	**Use of helicopter flight data**						

LO	Determine the fuel consumption from the helicopter performance data sheets in accordance with altitude and helicopter mass.			x	x		
034 04 04 00	**En route one engine inoperative**						
034 04 04 01	**Requirements for en route flights for OEI**						
LO	State the flight-path clearance requirements.			x	x		
LO	Explain the drift-down techniques.			x	x		
LO	State the reduction in the flight-path width when navigational accuracy can be achieved.			x	x		
034 04 04 02	**Use of helicopter flight data**						
LO	Find the single-engine service ceiling, range and endurance from given engine-inoperative charts.			x	x		
LO	Find the maximum continuous power settings from given engine-inoperative charts.			x	x		
LO	Find the amount of fuel to be jettisoned to reduce helicopter mass.			x	x		
LO	Calculate the relevant parameters for drift-down procedures.			x	x		
034 04 05 00	**Descent**						
034 04 05 01	**Use of helicopter flight data**						
LO	Find the rate of descent and calculate the time to descent to a given altitude.			x	x		
034 04 06 00	**Landing**						
034 04 06 01	**Landing requirements**						
LO	State the requirements for landing.			x	x		
034 04 06 02	**Landing procedures**						
LO	Explain the procedure for critical power-unit failure prior to and after the landing decision point.			x	x		
LO	Explain that the portion of flight after the landing decision point must be carried out visually.			x	x		
LO	Explain the procedures and required obstacle clearances for landings on different heliports/helidecks.			x	x		
034 04 06 03	**Use of helicopter flight data**						
LO	Determine from the helicopter performance data sheets the maximum masses that satisfy all the regulations for landing.			x	x		

H. SUBJECT 040 — HUMAN PERFORMANCE AND LIMITATIONS

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
040 00 00 00	**HUMAN PERFORMANCE**						
040 01 00 00	**HUMAN FACTORS: BASIC CONCEPTS**						
040 01 01 00	**Human factors in aviation**						
040 01 01 01	**Becoming a competent pilot**						
LO	State that competency is based on the knowledge, skill and ability of the individual pilot.	x	x	x	x	x	x
LO	Outline the factors in training that will ensure the future competency of the individual pilot.	x	x	x	x	x	x
040 01 02 00	**Accident statistics**						
LO	Give an estimate of the accident rate in commercial aviation in comparison to other means of transport.	x	x	x	x	x	x
LO	State in general terms the percentage of aircraft accidents which are caused by human factors.	x	x	x	x	x	x
LO	Summarise the accident trend in modern aviation.	x	x	x	x	x	x
LO	Identify the role of accident statistics in developing a strategy for future improvements to flight safety.	x	x	x	x	x	x
040 01 03 00	**Flight safety concepts**						
LO	Explain the three components of the Threat and Error Management (TEM) model.	x	x	x	x	x	x
LO	Explain and give examples of latent threats.	x	x	x	x	x	x
LO	Explain and give examples of environmental threats.	x	x	x	x	x	x
LO	Explain and give examples of organisational threats.	x	x	x	x	x	x
LO	Explain and give a definition of 'error' according to the TEM model of ICAO Annex 1.	x	x	x	x	x	x
LO	Give examples of different countermeasures which may be used in order to manage threats, errors and undesired aircraft states.	x	x	x	x	x	x
LO	Explain and give examples of procedural error.	x	x	x	x	x	x

LO	Explain and give examples of 'undesired aircraft states'.	x	x	x	x	x	x
LO	Describe and compare the elements of the SHELL model.	x	x	x	x	x	x
LO	Summarise the relevance of the SHELL model to the work in the cockpit.	x	x	x	x	x	x
LO	Analyse the interaction between the various components of the SHELL model.	x	x	x	x	x	x
LO	Explain how the interaction between individual crew members can affect flight safety.	x	x	x	x	x	x
LO	Identify and explain the interaction between flight crew and management as a factor in flight safety.	x	x	x	x	x	x
040 01 04 00	**Safety culture**						
LO	Distinguish between 'open cultures' and 'closed cultures'.	x	x	x	x	x	x
LO	Illustrate how safety culture is reflected in national culture.	x	x	x	x	x	x
LO	Question the established expression 'safety first' in a commercial entity.	x	x	x	x	x	x
LO	Explain James Reason's 'Swiss Cheese Model'.	x	x	x	x	x	x
LO	State the important factors that promote a good safety culture.	x	x	x	x	x	x
LO	Distinguish between 'just culture' and 'non-punitive culture'.	x	x	x	x	x	x
LO	Name the five components which form safety culture (according to James Reason).	x	x	x	x	x	x
040 02 01 00	**Basics of flight physiology**						
040 02 01 01	**The atmosphere**						
LO	State the units used in measuring total and partial pressures of the gases in the atmosphere.	x	x	x	x	x	x
LO	State in terms of % and mm Hg the values of oxygen, nitrogen and other gases present in the atmosphere.	x	x	x	x	x	x
LO	State that the volume percentage of the gases in ambient air will remain constant for all altitudes at which conventional aircraft operate.	x	x	x	x	x	x

LO	State the physiological significance of the following laws: Boyle's Law; Dalton's Law; Henry's Laws; the General Gas Law.	x	x	x	x	x	x
LO	State the ICAO standard temperature at Mean Sea Level and the Standard Temperature Lapse Rate.	x	x	x	x	x	x
LO	State at what approximate altitudes in the standard atmosphere the atmospheric pressure will be ¼, ½ and ¾ of MSL pressure.	x	x	x	x	x	x
LO	State the effects of increasing altitude on the overall pressure and partial pressures of the various gases in the atmosphere.	x	x	x	x	x	x
LO	Explain the differences in gas expansion between alveolar and ambient air when climbing.	x	x	x	x	x	x
LO	State the condition required for human beings to be able to survive at any given altitude.	x	x	x	x	x	x
LO	State and explain the importance of partial pressure.	x	x	x	x	x	x
040 02 01 02	**Respiratory and circulatory system**						
LO	List the main components of the respiratory system and their function.	x	x	x	x	x	x
LO	Identify the different volumes of air in the lungs and state the normal respiratory rate.	x	x	x	x	x	x
LO	State how oxygen and carbon dioxide are transported throughout the body.	x	x	x	x	x	x
LO	Explain the process by which oxygen is transferred to the tissues and carbon dioxide is eliminated from the body and the oxygen requirement of tissues.	x	x	x	x	x	x
LO	Explain the role of carbon dioxide in the control and regulation of respiration.	x	x	x	x	x	x
LO	Describe the basic processes of external respiration and internal respiration.	x	x	x	x	x	x
LO	List the factors determining pulse rate.	x	x	x	x	x	x
LO	Name the major components of the circulatory system and describe their function.	x	x	x	x	x	x
LO	State the values for a normal pulse rate and the average cardiac output (heart rate × stroke volume) of an adult at rest.	x	x	x	x	x	x

LO	Name the four chambers of the heart and state the function of the individual chambers.	x	x	x	x	x	x
LO	Differentiate between arteries, veins and capillaries in their structure and function.	x	x	x	x	x	x
LO	State the functions of the coronary arteries and veins.	x	x	x	x	x	x
LO	Define ‘systolic’ and ‘diastolic’ blood pressure.	x	x	x	x	x	x
LO	State the normal blood pressure ranges and units of measurement.	x	x	x	x	x	x
LO	State that in an average pilot blood pressure will rise slightly with age as the arteries lose their elasticity.	x	x	x	x	x	x
LO	List the main constituents of the blood and describe their functions.	x	x	x	x	x	x
LO	Stress the function of haemoglobin in the circulatory system.	x	x	x	x	x	x
LO	Define ‘anaemia’ and state its common causes.	x	x	x	x	x	x
LO	Indicate the effect of increasing altitude on haemoglobin oxygen saturation.	x	x	x	x	x	x
	Hypertension and hypotension						
LO	Define ‘hypertension’ and ‘hypotension’.	x	x	x	x	x	x
LO	List the effects that high and low blood pressure will have on some normal functions of the human body.	x	x	x	x	x	x
LO	State that both hypotension and hypertension may disqualify the pilot from obtaining a medical clearance to fly.	x	x	x	x	x	x
LO	List the factors which can lead to hypertension in an individual.	x	x	x	x	x	x
LO	State the corrective actions that may be taken to reduce high blood pressure.	x	x	x	x	x	x
LO	Stress that hypertension is the major factor of ‘strokes’ in the general population.	x	x	x	x	x	x
	Coronary artery disease						
LO	Differentiate between ‘angina’ and ‘heart attack’.	x	x	x	x	x	x
LO	Explain the major risk factors for coronary disease.	x	x	x	x	x	x
LO	State the role played by physical exercise in reducing the chances of developing coronary disease.	x	x	x	x	x	x
	Hypoxia						

LO	Define the two major forms of hypoxia (hypoxic and anaemic), and the common causes of both.	x	x	x	x	x	x
LO	State the symptoms of hypoxia.	x	x	x	x	x	x
LO	State why living tissues require oxygen.	x	x	x	x	x	x
LO	State that healthy people are able to compensate for altitudes up to approximately 10 000–12 000 ft.	x	x	x	x	x	x
LO	Name the three physiological thresholds and allocate the corresponding altitudes for each of them.	x	x	x	x	x	x
LO	State the altitude at which short-term memory begins to be affected by hypoxia.	x	x	x	x	x	x
LO	Define the term 'Time of Useful Consciousness' (TUC).	x	x	x	x	x	x
LO	State that TUC varies between individuals, but the approximate values are: a) for a person seated (at rest) b) for a person moderately active 20 000 ft a) 30 min b) 5 min 30 000 ft a) 1–2 min b) not required 35 000 ft a) 30–90 sec b) not required 40 000 ft a) 15–20 sec b) not required	x	x	x	x	x	x
LO	Explain the dangers of flying above 10 000 ft without using additional oxygen or being in a pressurised cabin.	x	x	x	x	x	x
LO	List the factors determining the severity of hypoxia.	x	x	x	x	x	x
LO	State the precautions to be taken when giving blood.	x	x	x	x	x	x
LO	State the equivalent altitudes when breathing ambient air and 100 % oxygen for MSL and approximately 10 000, 30 000 and 40 000 ft.	x	x	x	x	x	x
	Hyperventilation						
LO	Describe the role of carbon dioxide in hyperventilation.	x	x	x	x	x	x
LO	Define the term 'hyperventilation'.	x	x	x	x	x	x
LO	List the factors causing hyperventilation.	x	x	x	x	x	x

LO	State that hyperventilation may be caused by psychological or physiological reasons.	x	x	x	x	x	x
LO	List the signs and symptoms of hyperventilation.	x	x	x	x	x	x
LO	Describe the effects of hyperventilation on muscular coordination.	x	x	x	x	x	x
LO	List the measures which may be taken to counteract hyperventilation.	x	x	x	x	x	x
	Decompression sickness/illness						
LO	State the normal range of cabin pressure altitude in pressurised commercial aircraft and describe its protective function for aircrew and passengers.	x	x	x	x	x	x
LO	Identify the causes of decompression sickness in flight operation.	x	x	x	x	x	x
LO	State how decompression sickness can be prevented.	x	x	x	x	x	x
LO	State the threshold for the onset of decompression sickness in terms of altitude.	x	x	x	x	x	x
LO	State the approximate altitude above which decompression sickness is likely to occur.	x	x	x	x	x	x
LO	List the symptoms of decompression sickness.	x	x	x	x	x	x
LO	Indicate how decompression sickness may be treated.	x	x	x	x	x	x
LO	List the vital actions the crew has to perform when cabin pressurisation is lost.	x	x	x	x	x	x
LO	Define the hazards of diving and flying, and give the recommendations associated with these activities.	x	x	x	x	x	x
	Acceleration						
LO	Define ‘linear’, ‘angular’ and ‘radial acceleration’.	x	x	x	x	x	x
LO	Describe the effects of acceleration on the circulation and blood volume distribution.	x	x	x	x	x	x
LO	List the factors determining the effects of acceleration on the human body.	x	x	x	x	x	x
LO	Describe the measures which may be taken to increase tolerance to positive acceleration.	x	x	x	x	x	x
LO	List the effects of positive acceleration with respect to type, sequence and the corresponding G-load.	x	x	x	x	x	x
	Carbon monoxide						
LO	State how carbon monoxide may be produced.	x	x	x	x	x	x

LO	State how the presence of carbon monoxide in the blood affects the distribution of oxygen.	x	x	x	x	x	x
LO	List the signs and symptoms of carbon-monoxide poisoning.	x	x	x	x	x	x
LO	Indicate how carbon-monoxide poisoning can be treated and countermeasures that can be adopted.	x	x	x	x	x	x
040 02 01 03	**High-altitude environment**						
	Ozone						
LO	State how an increase in altitude may change the proportion of ozone in the atmosphere.	x		x	x		
LO	List the possible harmful effects of ozone.	x		x	x		
	Radiation						
LO	State the sources of radiation at high altitude.	x		x	x		
LO	List the effects of excessive exposure to radiation.	x		x	x		
LO	State the effect of sun storms on the amount of radiation at high altitude.	x		x	x		
LO	List the harmful effects that may result from the extra radiation that may be generated as the result of a sun storm (solar flares).	x		x	x		
LO	List the methods of reducing the effects of extra radiation that may be generated as the result of a sun storm (solar flares).	x		x	x		
	Humidity						
LO	Define the terms 'humidity' and 'relative humidity'.	x		x	x		
LO	List the factors which affect the relative humidity of both the atmosphere and cabin air.	x		x	x		
LO	State the methods of reducing the effects of insufficient humidity.	x		x	x		
LO	List the physiological effects of dry cabin air on the human body and indicate measures to diminish these effects. Stress the effects that low humidity can have on the efficient functioning of the eye.	x		x	x		
	Extreme temperatures						
LO	Explain the change in the need for oxygen of the human body when exposed to extreme environmental temperatures.	x		x	x		
040 02 02 00	**Man and environment: the sensory system**						
LO	List the different senses.	x	x	x	x	x	x

LO	State the multisensory nature of human perception.	x	x	x	x	x	x
040 02 02 01	**Central, peripheral and autonomic nervous systems**						
LO	Name the main parts of the central nervous system.	x	x	x	x	x	x
LO	State the basic functions of the Central Nervous System (CNS), the Peripheral Nervous System (PNS) and the Autonomic (vegetative) Nervous System (ANS).	x	x	x	x	x	x
LO	Discuss broadly how information is processed by the nervous systems and the role of reflexes.	x	x	x	x	x	x
LO	Define the division of the peripheral nerves into sensory and motor nerves.	x	x	x	x	x	x
LO	State that a nerve impulse is an electrochemical phenomenon.	x	x	x	x	x	x
LO	Define the term ‘sensory threshold’.	x	x	x	x	x	x
LO	Define the term ‘sensitivity’, especially in the context of vision.	x	x	x	x	x	x
LO	Give examples of sensory adaptation.	x	x	x	x	x	x
LO	Define the term ‘habituation’ and state its implication for flight safety.	x	x	x	x	x	x
LO	Define the biological control systems as neurohormonal processes that are highly self-regulated in the normal environment.	x	x	x	x	x	x
040 02 02 02	**Vision**						
	Functional anatomy						
LO	Name the most important parts of the eye and the pathway to the visual cortex.	x	x	x	x	x	x
LO	State the basic functions of the parts of the eye.	x	x	x	x	x	x
LO	Define ‘accommodation’.	x	x	x	x	x	x
LO	Distinguish between the functions of the rod and cone cells.	x	x	x	x	x	x
LO	Describe the distribution of rod and cone cells in the retina and explain their relevance on vision.	x	x	x	x	x	x
	Visual foveal and peripheral vision						
LO	Explain the terms ‘visual acuity’, ‘visual field’, ‘central vision’, ‘peripheral vision’ and ‘fovea’ and explain their function in the process of vision.	x	x	x	x	x	x
LO	List the factors which may degrade visual acuity and the importance of ‘lookout’.	x	x	x	x	x	x

LO	State the limitations of night vision and the different scanning techniques by both night and day (regularly spaced eye movements each covering an overlapping sector of about 10°).	x	x	x	x	x	x
LO	Explain the adaptation mechanism in vision to cater for reduced and increased levels of illumination.	x	x	x	x	x	x
LO	State the time necessary for the eye to adapt both to dark and bright light.	x	x	x	x	x	x
LO	State the effect of hypoxia and smoking on night vision.	x	x	x	x	x	x
LO	Explain the nature of colour blindness and the significance of the 'blind spot' on the retina in detecting other traffic in flight.	x	x	x	x	x	x
	Binocular and monocular vision						
LO	Distinguish between monocular and binocular vision.	x	x	x	x	x	x
LO	Explain the basis of depth perception and its relevance to flight performance.	x	x	x	x	x	x
LO	List the possible monocular cues for depth perception.	x	x	x	x	x	x
LO	State the problems of vision associated with higher energy blue light and ultraviolet rays.	x	x	x	x	x	x
	Defective vision						
LO	Explain long sightedness, short sightedness and astigmatism.	x	x	x	x	x	x
LO	List the causes of and the precautions that may be taken to reduce the probability of vision loss due to: presbyopia, cataracts, glaucoma.	x	x	x	x	x	x
LO	List the types of sunglasses which could cause perceptional problems in flight.	x	x	x	x	x	x
LO	List the measures which may be taken to protect oneself from flash blindness.	x	x	x	x	x	x
LO	State the possible problems associated with contact lenses.	x	x	x	x	x	x
LO	State the current rules/regulations governing the wearing of corrective spectacles and contact lenses when operating as a pilot.	x	x	x	x	x	x
040 02 02 03	**Hearing**						

	Descriptive and functional anatomy						
LO	State the audible range of the human ear.	x	x	x	x	x	x
LO	State the unit of measure for the intensity of sound.	x	x	x	x	x	x
LO	Name the most important parts of the ear and the associated neural pathway.	x	x	x	x	x	x
LO	State the basic functions of the different parts of the auditory system.	x	x	x	x	x	x
LO	Differentiate between the functions of the vestibular apparatus and the cochlea in the inner ear.	x	x	x	x	x	x
LO	State the role of the Eustachian tube in equalising pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	Indicate the effects of colds or flu on the ability to equalise pressure in the above.	x	x	x	x	x	x
	Hearing loss						
LO	Define the main causes of the following hearing defects/loss: 'conductive deafness'; 'Noise-Induced Hearing Loss' (NIHL); 'presbycusis'.	x	x	x	x	x	x
LO	Summarise the effects of environmental noise on hearing.	x	x	x	x	x	x
LO	State the decibel level of received noise that will cause NIHL.	x	x	x	x	x	x
LO	Indicate the factors, other than noise level, which may lead to NIHL.	x	x	x	x	x	x
LO	Identify the potential occupational risks which may cause hearing loss.	x	x	x	x	x	x
LO	List the main sources of hearing loss in the flying environment.	x	x	x	x	x	x
LO	List the precautions that may be taken to reduce the probability of onset of hearing loss.	x	x	x	x	x	x
040 02 02 04	**Equilibrium**						
	Functional anatomy						
LO	List the main elements of the vestibular apparatus.	x	x	x	x	x	x
LO	State the functions of the vestibular apparatus on the ground and in flight.	x	x	x	x	x	x

LO	Distinguish between the component parts of the vestibular apparatus in the detection of linear and angular acceleration as well as on gravity.	x	x	x	x	x	x
LO	Explain how the semicircular canals are stimulated.	x	x	x	x	x	x
	Motion sickness						
LO	Describe airsickness and its accompanying symptoms.	x	x	x	x	x	x
LO	Indicate that vibration can cause undesirable human responses because of the resonance of the skull and the eyeballs.	x	x	x	x	x	x
LO	List the causes of motion sickness.	x	x	x	x	x	x
LO	Describe the necessary actions to be taken to counteract the symptoms of motion sickness.	x	x	x	x	x	x
040 02 02 05	**Integration of sensory inputs**						
LO	State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight.	x	x	x	x	x	x
LO	Define the term 'illusion'.	x	x	x	x	x	x
LO	Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons and surface planes.	x	x	x	x	x	x
LO	Relate these illusions to problems that may be experienced in flight and identify the danger attached to them.	x	x	x	x	x	x
LO	State the conditions which cause the 'black-hole' effect and 'empty-field myopia'.	x	x	x	x	x	x
LO	Give examples of approach and landing illusions, state the danger involved and give recommendations to avoid or counteract these problems.	x	x	x	x	x	x
LO	State the problems associated with flickering lights (strobe lights, anti-collision lights, etc.).	x	x	x	x	x	x
LO	Give examples of vestibular illusions such as somatogyral (the Leans), Coriolis, somatogravic and G-effect illusions.	x	x	x	x	x	x
LO	Relate the above-mentioned vestibular illusions to problems encountered in flight and state the dangers involved.	x	x	x	x	x	x

LO	List and describe the function of the proprioceptive senses ('seat-of-the-pants' sense).	x	x	x	x	x	x
LO	Relate illusions of the proprioceptive senses to the problems encountered during flight.	x	x	x	x	x	x
LO	State that the 'seat-of-the-pants' sense is completely unreliable when visual contact with the ground is lost or when flying in IMC or poor visual horizon.	x	x	x	x	x	x
LO	Differentiate between vertigo, Coriolis effect and spatial disorientation.	x	x	x	x	x	x
LO	Explain the flicker effect (stroboscopic effect) and discuss the countermeasures.	x	x	x	x	x	x
LO	Explain how spatial disorientation can result from a mismatch in sensory input and information processing.	x	x	x	x	x	x
LO	List the measures to prevent and/or overcome spatial disorientation.	x	x	x	x	x	x
040 02 03 00	**Health and hygiene**						
040 02 03 01	**Personal hygiene**						
LO	Summarise the role of personal hygiene as a factor in human performance.	x	x	x	x	x	x
040 02 03 02	**Body rhythm and sleep**						
LO	Name some internal body rhythms and their relevance to sleep.	x		x	x		
LO	Explain the term 'circadian rhythm'.	x		x	x		
LO	State the approximate duration of a 'free-running' rhythm.	x		x	x		
LO	Explain the significance of the 'internal clock' in regulating the normal circadian rhythm.	x		x	x		
LO	State the effect of the circadian rhythm of body temperature on an individual's performance standard and the effect on an individual's sleep patterns.	x		x	x		
LO	List and describe the stages of a sleep cycle.	x		x	x		
LO	Differentiate between REM and non-REM sleep.	x		x	x		
LO	Explain the function of sleep and describe the effects of insufficient sleep on performance.	x		x	x		
LO	Explain the simple calculations for the sleep/wake credit/debit situation.	x		x	x		

LO	Explain how sleep debit can become cumulative.	x		x	x		
LO	State the time formula for the adjustment of body rhythms to the new local time scale after crossing time zones.	x		x	x		
LO	State the problems caused by circadian disrhythmia (jet lag) with regard to an individual's performance and sleep.	x		x	x		
LO	Differentiate between the effects of westbound and eastbound travel.	x		x	x		
LO	Explain the interactive effects of circadian rhythm and vigilance on a pilot's performance during flight as the duty day elapses.	x		x	x		
LO	Describe the main effects of lack of sleep on an individual's performance.	x		x	x		
LO	List the possible coping strategies for jet lag.	x		x	x		
040 02 03 03	**Problem areas for pilots**						
	Common minor ailments						
LO	State the role of the Eustachian tube in equalising pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	State that the in-flight environment may increase the severity of symptoms which may be minor while on the ground.	x	x	x	x	x	x
LO	List the negative effects of suffering from colds or flu on flight operations especially with regard to the middle ear, the sinuses, and the teeth.	x	x	x	x	x	x
LO	Indicate the effects of colds or flu on the ability to equalise pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	State when a pilot should seek medical advice from an AME, and when the aeromedical section of an authority should be informed.	x	x	x	x	x	x
LO	Describe the measures to prevent and/or clear problems due to pressure changes during flight.	x	x	x	x	x	x
	Entrapped gases and barotrauma						
LO	Define 'barotrauma'.	x	x	x	x	x	x
LO	Differentiate between otic, sinus, gastrointestinal and aerodontalgia (of the teeth) barotraumas and explain avoidance strategies.	x	x	x	x	x	x

LO	Explain why the effects of otic barotrauma can be worse in the descent.	x	x	x	x	x	x
	Gastrointestinal upsets						
LO	State the effects of gastrointestinal upsets that may occur during flight.	x	x	x	x	x	x
LO	List the precautions that should be observed to reduce the occurrence of gastrointestinal upsets.	x	x	x	x	x	x
LO	Indicate the major sources of gastrointestinal upsets.	x	x	x	x	x	x
	Obesity						
LO	Define 'obesity'.	x	x	x	x	x	x
LO	State the cause of obesity.	x	x	x	x	x	x
LO	State the harmful effects of obesity on the following: possibility of developing coronary problems; increased chances of developing diabetes; ability to withstand G forces; the development of problems with the joints of the limbs; general circulatory problems; ability to cope with hypoxia and/or decompression sickness.	x	x	x	x	x	x
LO	State the relationship between obesity and Body Mass Index (BMI).	x	x	x	x	x	x
LO	Calculate the BMI of an individual (given weight in kilograms and height in metres) and state whether this BMI indicates that the individual is underweight, overweight, obese or within the normal range of body weight.	x	x	x	x	x	x
LO	Describe the problems associated with Type 2 (mostly adult) diabetes risk factors; insulin resistance; complications (vascular, neurological) and the consequences for the medical licence; pilots are not protected from Type 2 diabetes more than other people.	x	x	x	x	x	x
	Back pain						

LO	Describe the typical back problems (unspecific back pain, slipped disc) that pilots have. Explain also the ways of preventing and treating these problems: good sitting posture; lumbar support; good physical condition; in-flight exercise, if possible; physiotherapy.	x	x	x	x	x	x
	Food hygiene						
LO	Explain the significance of food hygiene with regard to general health.	x	x	x	x	x	x
LO	Stress the importance of and methods to be adopted by aircrew especially when travelling abroad to avoid contaminated food and liquids.	x	x	x	x	x	x
LO	List the major contaminating sources in foodstuffs.	x	x	x	x	x	x
LO	State the major constituents of a healthy diet.	x	x	x	x	x	x
LO	State the measure to avoid hypoglycaemia.	x	x	x	x	x	x
LO	State the role vitamins and trace elements are playing in a healthy diet.	x	x	x	x	x	x
LO	State the importance of adequate hydration.	x	x	x	x	x	x
	Tropical climates						
LO	List the problems associated with operating in tropical climates.	x		x	x		
LO	State the possible causes/sources of incapacitation in tropical or poorly developed countries with reference to: standards of hygiene; quality of water supply; insectborne diseases; parasitic worms; rabies or other diseases that may be spread by contact with animals; sexually transmitted diseases.	x		x	x		
LO	State the precautions to be taken to reduce the risks of developing problems in tropical areas.	x		x	x		
	Infectious diseases						

LO	State the major infectious diseases that may kill or severely incapacitate individuals.	x	x	x	x	x	x
LO	State which preventative hygienic measures, vaccinations, drugs and other measures reduce the chances of catching these diseases.	x	x	x	x	x	x
LO	State the precautions which must be taken to ensure that disease-carrying insects are not transported between areas.	x	x	x	x	x	x
040 02 03 04	**Intoxication**						
	Tobacco						
LO	State the harmful effects of tobacco on: the respiratory system; the cardiovascular system; the ability to resist hypoxia; the ability to tolerate G forces; night vision.	x	x	x	x	x	x
	Caffeine						
LO	Indicate the level of caffeine dosage at which performance is degraded.	x	x	x	x	x	x
LO	Besides coffee, indicate other beverages containing caffeine.	x	x	x	x	x	x
	Alcohol						
LO	State the maximum acceptable limit of alcohol for flight crew according to the applicable regulations.	x	x	x	x	x	x
LO	State the effects of alcohol consumption on: the ability to reason; inhibitions and self-control; vision; the sense of balance and sensory illusions; sleep patterns; hypoxia.	x	x	x	x	x	x
LO	State the effects alcohol may have if consumed together with other drugs.	x	x	x	x	x	x
LO	List the signs and symptoms of alcoholism.	x	x	x	x	x	x
LO	List the factors which may be associated with the development of alcoholism.	x	x	x	x	x	x

LO	Define the ‘unit’ of alcohol and state the approximate elimination rate from the blood.	x	x	x	x	x	x
LO	State the maximum daily and weekly intake of units of alcohol which may be consumed without causing damage to organs and systems in the body.	x	x	x	x	x	x
LO	Discuss the actions that might be taken if a crew member is suspected of being an alcoholic.	x		x	x		
LO	State the reasons why aviation professions are particularly vulnerable to the excessive use of alcohol.	x		x	x		
	Drugs and self-medication						
LO	State the dangers associated with the use of non-prescription drugs.	x	x	x	x	x	x
LO	State the side effects of common non-prescription drugs used to treat colds, flu, hay fever and other allergies, especially medicines containing antihistamine preparations.	x	x	x	x	x	x
LO	Interpret the rules relevant to using (prescription or non-prescription) drugs that the pilot has not used before.	x	x	x	x	x	x
LO	Interpret the general rule that ‘if a pilot is so unwell that they require any medication, then they should consider themselves unfit to fly’.	x	x	x	x	x	x
	Toxic materials						
LO	List those materials present in an aircraft which may, when uncontained, cause severe health problems.	x	x	x	x	x	x
LO	List those aircraft-component parts which if burnt may give off toxic fumes.	x	x	x	x	x	x
040 02 03 05	**Incapacitation in flight**						
LO	State that incapacitation is most dangerous when its onset is insidious.	x	x	x	x	x	x
LO	List the major causes of in-flight incapacitation.	x	x	x	x	x	x
LO	State the importance of crew to be able to recognise and promptly react upon incapacitation of other crew members, should it occur in flight.	x		x	x		
LO	Explain coping methods and procedures.	x	x	x	x	x	x
040 03 00 00	**BASIC AVIATION PSYCHOLOGY**						
040 03 01 00	**Human information processing**						
040 03 01 01	**Attention and vigilance**						

LO	Differentiate between 'attention' and 'vigilance'.	x	x	x	x	x	x
LO	Differentiate between 'selected' and 'divided' attention.	x	x	x	x	x	x
LO	Define 'hypovigilance'.	x	x	x	x	x	x
LO	Identify the factors which may affect the state of vigilance.	x	x	x	x	x	x
LO	List the factors that may forestall hypovigilance during flight.	x	x	x	x	x	x
LO	Indicate the signs of reduced vigilance.	x	x	x	x	x	x
LO	Name the factors that affect a person's level of attention.	x	x	x	x	x	x
040 03 01 02	**Perception**						
LO	Name the basis of the perceptual process.	x	x	x	x	x	x
LO	Describe the mechanism of perception ('bottom-up'/'top-down' process).	x	x	x	x	x	x
LO	Illustrate why perception is subjective and state the relevant factors which influence interpretation of perceived information.	x	x	x	x	x	x
LO	Describe some basic perceptual illusions.	x	x	x	x	x	x
LO	Illustrate some basic perceptual concepts.	x	x	x	x	x	x
LO	Give examples where perception plays a decisive role in flight safety.	x	x	x	x	x	x
LO	Stress how persuasive and believable mistaken perception can manifest itself both on an individual and a group.	x	x	x	x	x	x
040 03 01 03	**Memory**						
LO	Explain the link between the types of memory (to include sensory, working/short-term and long-term memories).	x	x	x	x	x	x
LO	Describe the differences between the types of memory in terms of capacity and retention time.	x	x	x	x	x	x
LO	Justify the importance of sensory-store memories in processing information.	x	x	x	x	x	x
LO	State the average maximum number of separate items that may be held in working memory.	x	x	x	x	x	x
LO	Stress how interruption can affect short-term/working memory.	x	x	x	x	x	x

LO	Give examples of items that are important for pilots to hold in working memory during flight.	x	x	x	x	x	x
LO	Describe how the capacity of the working-memory store may be increased.	x	x	x	x	x	x
LO	State the subdivisions of long-term memory and give examples of their content.	x	x	x	x	x	x
LO	Explain that skills are kept primarily in the long-term memory.	x	x	x	x	x	x
LO	Explain amnesia and how it effects memory.	x	x	x	x	x	x
LO	Name the common problems with both the long and short-term memories and the best methods to try to counteract them.	x	x	x	x	x	x
040 03 01 04	**Response selection**						
	Learning principles and techniques						
LO	Explain and distinguish between the following basic forms of learning: classical and operant conditioning (behaviouristic approach); learning by insight (cognitive approach); learning by imitating (modelling).	x	x	x	x	x	x
LO	Find pilot-related examples for each of these learning forms.	x	x	x	x	x	x
LO	State the factors which are necessary for and promote the quality of learning.	x	x	x	x	x	x
LO	Explain ways to facilitate the memorisation of information with the following learning techniques: mnemonics; mental training.	x	x	x	x	x	x
LO	Describe the advantage of planning and anticipation of future actions: define the term ‘skills’; state the three phases of learning a skill (Anderson).	x	x	x	x	x	x
LO	Explain the term ‘motor programme’ or ‘mental schema’.	x	x	x	x	x	x
LO	Describe the advantages and disadvantages of mental schemata.	x	x	x	x	x	x

LO	Explain the Rasmussen model which describes the guidance of a pilot's behaviour in different situations.	x	x	x	x	x	x
LO	State the possible problems or risks associated with skill-based, rule-based and knowledge-based behaviour.	x	x	x	x	x	x
LO	Explain the following phases in connection with the acquisition of automated behaviour: cognitive phase; associative phase; automatic phase.	x	x	x	x	x	x
	Motivation						
LO	Define 'motivation'.	x	x	x	x	x	x
LO	Explain the influences of different levels of motivation on performance taking into consideration task difficulty.	x	x	x	x	x	x
LO	Explain the 'Model of human needs' (Maslow) and relate this to aviation.	x	x	x	x	x	x
LO	Explain the relationship between motivation and learning.	x	x	x	x	x	x
LO	Explain the problems of overmotivation, especially in the context of extreme need of achievement.	x	x	x	x	x	x
040 03 02 00	**Human error and reliability**						
040 03 02 01	**Reliability of human behaviour**						
LO	Name and explain the factors which influence human reliability.	x	x	x	x	x	x
040 03 02 02	**Mental models and situation awareness**						
LO	Define the term 'situation awareness'.	x	x	x	x	x	x
LO	List the cues which indicate loss of situation awareness and name the steps to regain it.	x	x	x	x	x	x
LO	List the factors which influence one's situation awareness both positively and negatively, and stress the importance of situation awareness in the context of flight safety.	x	x	x	x	x	x
LO	Define the term 'mental model' in relation to a surrounding complex situation.	x	x	x	x	x	x
LO	Describe the advantages/ disadvantages of mental models.	x	x	x	x	x	x

LO	Explain the relationship between personal 'mental models' and the creation of cognitive illusions.	x	x	x	x	x	x
040 03 02 03	**Theory and model of human error**						
LO	Define the term 'error'.	x	x	x	x	x	x
LO	Explain the concept of the 'error chain'.	x	x	x	x	x	x
LO	Differentiate between an isolated error and an error chain.	x	x	x	x	x	x
LO	Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations).	x	x	x	x	x	x
LO	Discuss the above errors and their relevance in flight.	x	x	x	x	x	x
LO	Distinguish between an active and a latent error and give examples.	x	x	x	x	x	x
040 03 02 04	**Error generation**						
LO	Distinguish between internal and external factors in error generation.	x	x	x	x	x	x
LO	Identify possible sources of internal error generation.	x	x	x	x	x	x
LO	Define and discuss the two errors associated with motor programmes.	x	x	x	x	x	x
LO	List the three main sources of external error generation in the cockpit.	x	x	x	x	x	x
LO	Give examples to illustrate the following factors in external error generation in the cockpit: ergonomics, economics, social environment.	x	x	x	x	x	x
LO	Name the major goals in the design of human-centred man–machine interfaces.	x	x	x	x	x	x
LO	Define the term 'error tolerance'.	x	x	x	x	x	x
LO	List (and describe) strategies which are used to reduce human error.	x	x	x	x	x	x
040 03 03 00	**Decision-making**						
040 03 03 01	**Decision-making concepts**						
LO	Define the terms 'deciding' and 'decision-making'.	x	x	x	x	x	x
LO	Describe the major factors on which decision-making should be based during the course of a flight.	x	x	x	x	x	x

LO	Describe the main human attributes with regard to decision-making.	x	x	x	x	x	x
LO	Discuss the nature of bias and its influence on the decision-making process.	x	x	x	x	x	x
LO	Describe the main error sources and limits in an individual's decision-making mechanism.	x	x	x	x	x	x
LO	State the factors upon which an individual's risk assessment is based.	x	x	x	x	x	x
LO	Explain the relationship between risk assessment, commitment and pressure of time on decision-making strategies.	x	x	x	x	x	x
LO	Explain the risks associated with dispersion and/or channelised attention during the application of procedures requiring a high workload within a short time frame (e.g. a go-around).	x	x	x	x	x	x
LO	Describe the positive and negative influences exerted by other group members on an individual's decision-making process.	x	x	x	x	x	x
LO	Explain the general idea behind the creation of a model for decision-making based upon: definition of the aim; collection of information; risk assessment; development of options; evaluation of options; decision; implementation; consequences; review and feedback.	x	x	x	x	x	x
040 03 04 00	**Avoiding and managing errors: cockpit management**						
040 03 04 01	**Safety awareness**						
LO	Justify the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks.	x	x	x	x	x	x
LO	Stress the overall importance of constantly and positively striving to monitor for errors and thereby maintaining situation awareness.	x	x	x	x	x	x

040 03 04 02	**Coordination (multi-crew concepts)**						
LO	Name the objectives of the multi-crew concept.	x		x	x		
LO	State and explain the elements of multi-crew concepts.	x		x	x		
LO	Explain the concept ‘Standard Operating Procedures’ (SOPs).	x		x	x		
LO	Illustrate the purpose and procedure of crew briefings.	x		x	x		
LO	Illustrate the purpose and procedure of checklists.	x		x	x		
LO	Describe the function of communication in a coordinated team.	x		x	x		
040 03 04 03	**Cooperation**						
LO	Distinguish between cooperation and coaction.	x		x	x		
LO	Define the term ‘group’.	x		x	x		
LO	Illustrate the influence of interdependence in a group.	x		x	x		
LO	List the advantages and disadvantages of team work.	x		x	x		
LO	Explain the term ‘synergy’.	x		x	x		
LO	Define the term ‘cohesion’.	x		x	x		
LO	Define the term ‘groupthink’.	x		x	x		
LO	State the essential conditions for good teamwork.	x		x	x		
LO	Explain the function of role and norm in a group.	x		x	x		
LO	Name the different role patterns which occur in a group situation.	x		x	x		
LO	Explain how behaviour can be affected by the following factors: persuasion, conformity, compliance, obedience.	x		x	x		
LO	Distinguish between status and role.	x		x	x		
LO	Stress the inherent dangers of a situation where there is a mix of role and status within the cockpit.	x		x	x		
LO	Explain the terms ‘leadership’ and ‘followership’.	x		x	x		

LO	Describe the trans-cockpit authority gradient and its affiliated leadership styles (i.e. autocratic, laissez-faire and synergistic).	x		x	x		
LO	Name the most important attributes of a positive leadership style.	x		x	x		
040 03 04 04	**Communication**						
LO	Explain the function of 'information'.	x	x	x	x	x	x
LO	Define the term 'communication'.	x	x	x	x	x	x
LO	List the most basic components of interpersonal communication.	x	x	x	x	x	x
LO	Explain the advantages of two-way communication as opposed to one-way communication.	x	x	x	x	x	x
LO	Explain Watzlawick's statement 'One cannot not communicate'.	x	x	x	x	x	x
LO	Distinguish between verbal and non-verbal communication.	x	x	x	x	x	x
LO	Name the functions of non-verbal communication.	x	x	x	x	x	x
LO	Describe the general aspects of non-verbal communication.	x	x	x	x	x	x
LO	Describe the advantages/disadvantages of implicit and explicit communication.	x	x	x	x	x	x
LO	State the attributes and possible problems of using 'professional' language.	x	x	x	x	x	x
LO	Name and explain the major obstacles to effective communication.	x	x	x	x	x	x
LO	Give examples of aircraft accidents arising from poor communication.	x	x	x	x	x	x
LO	Explain the difference between intrapersonal and interpersonal conflict.	x	x	x	x	x	x
LO	Describe the escalation process in human conflict.	x	x	x	x	x	x
LO	List the typical consequences of conflicts between crew members.	x	x	x	x	x	x

LO	Explain the following terms as part of the communication practice with regard to preventing or resolving conflicts: inquiry, active listening, advocacy, feedback, metacommunication, negotiation.	x	x	x	x	x	x
040 03 05 00	**Human behaviour**						
040 03 05 01	**Personality, attitude and behaviour**						
LO	Describe the factors which determine an individual's behaviour.	x	x	x	x	x	x
LO	Define and distinguish between 'personality', 'attitude' and 'behaviour'.	x	x	x	x	x	x
LO	State the origin of personality and attitudes.	x	x	x	x	x	x
LO	State that with behaviours good and bad habits can be formed.	x	x	x	x	x	x
LO	Explain how behaviour is generally a product of personality and attitude.	x	x	x	x	x	x
LO	Discuss some effects that personality and attitudes may have on flight crew performance.	x	x	x	x	x	x
040 03 05 02	**Individual differences in personality and motivation**						
LO	Describe the individual differences in personality by means of a common trait model (e.g. Eysenck's personality factors) and use it to describe today's ideal pilot.	x	x	x	x	x	x
	Self-concept						
LO	Define the term 'self-concept' and the role it plays in any change of personality.	x	x	x	x	x	x
LO	Explain how a self-concept of underconfidence may lead to an outward show of aggression and self-assertiveness.	x	x	x	x	x	x
	Self-discipline						
LO	Define 'self-discipline' and justify its importance for flight safety.	x	x	x	x	x	x

040 03 05 03	**Identification of hazardous attitudes (error proneness)**						
LO	Summarise examples of attitudes and behaviour (including their signs) which, if prevalent in a crew member, might represent a hazard to flight safety.	x		x	x		
LO	Describe the personality attitude and behaviour patterns of an ideal crew member.	x		x	x		
LO	Summarise how a person’s attitude influences their work in the cockpit.	x		x	x		
040 03 06 00	**Human overload and underload**						
040 03 06 01	**Arousal**						
LO	Explain the term ‘arousal’.	x	x	x	x	x	x
LO	Describe the relationship between arousal and performance.	x	x	x	x	x	x
LO	Explain the circumstances under which underload may occur and its possible dangers.	x	x	x	x	x	x
040 03 06 02	**Stress**						
LO	Explain the term ‘homeostasis’.	x	x	x	x	x	x
LO	Explain the term ‘stress’ and why stress is a natural human reaction.	x	x	x	x	x	x
LO	State that the physiological response to stress is generated by the ‘fight or flight’ response.	x	x	x	x	x	x
LO	Describe the function of the Autonomic Nervous System (ANS) in stress response.	x	x	x	x	x	x
LO	Explain the biological reaction to stress by means of the ‘General Adaptation Syndrome’ (GAS).	x	x	x	x	x	x
LO	Explain the relationship between arousal and stress.	x	x	x	x	x	x
LO	State the relationship between stress and performance.	x	x	x	x	x	x
LO	State the basic categories of stressors.	x	x	x	x	x	x
LO	List and discuss the major environmental sources of stress in the cockpit.	x	x	x	x	x	x
LO	Discuss the concept of ‘break point’ with regard to stress, overload and performance.	x	x	x	x	x	x
LO	Name the principal causes of domestic stress.	x	x	x	x	x	x
LO	State that the stress experienced as a result of particular demands varies between individuals.	x	x	x	x	x	x

LO	Explain the factors which lead to differences in the levels of stress experienced by individuals.	x	x	x	x	x	x
LO	List the factors influencing the tolerance of stressors.	x	x	x	x	x	x
LO	Explain a simple model of stress.	x	x	x	x	x	x
LO	Explain the relationship between stress and anxiety.	x	x	x	x	x	x
LO	Describe the effects of anxiety on human performance.	x	x	x	x	x	x
LO	State the general effect of acute stress on the human system.	x	x	x	x	x	x
LO	Name the three phases of GAS.	x	x	x	x	x	x
LO	Name the symptoms of stress relating to the different phases of GAS.	x	x	x	x	x	x
LO	Describe the relationship between stress, arousal and vigilance.	x	x	x	x	x	x
LO	State the general effect of chronic stress on the human system.	x	x	x	x	x	x
LO	Explain the differences between psychological, psychosomatic and somatic stress reactions.	x	x	x	x	x	x
LO	Name the typical common physiological and psychological symptoms of human overload.	x	x	x	x	x	x
LO	Describe the effects of stress on human behaviour.	x	x	x	x	x	x
LO	Explain how stress is cumulative and how stress from one situation can be transferred to a different situation.	x	x	x	x	x	x
LO	Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future.	x	x	x	x	x	x
LO	Describe the effect of human underload/overload on effectiveness in the cockpit.	x	x	x	x	x	x
LO	List sources and symptoms of human underload.	x	x	x	x	x	x
040 03 06 03	**Intentionally left blank**						
040 03 06 04	**Intentionally left blank**						
040 03 06 05	**Fatigue and stress management**						
LO	Explain the term ‘fatigue’ and differentiate between the two types of fatigue.	x	x	x	x	x	x
LO	Name the causes for both types.	x	x	x	x	x	x

LO	Identify the symptoms and describe the effects of fatigue.	x	x	x	x	x	x
LO	List the strategies which prevent or delay the onset of fatigue and hypovigilance.	x	x	x	x	x	x
LO	List and describe coping strategies for dealing with stress factors and stress reactions.	x	x	x	x	x	x
LO	Distinguish between short-term and long-term methods of stress management.	x	x	x	x	x	x
LO	Give examples of short-term methods of stress management.	x	x	x	x	x	x
LO	Give examples of long-term methods of coping with stress.	x	x	x	x	x	x
040 03 07 00	**Advanced cockpit automation**						
040 03 07 01	**Advantages and disadvantages**						
LO	Define and explain the basic concept of automation.	x	x	x	x	x	x
LO	List the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situation awareness and crew coordination.	x	x	x	x	x	x
LO	State the advantages and disadvantages of the two components of the man–machine system with regard to information input and processing, decision-making and output activities.	x	x	x	x	x	x
LO	Explain the 'ironies of automation'.	x	x	x	x	x	x
LO	Give examples of methods to overcome the disadvantages of automation.	x	x	x	x	x	x
040 03 07 02	**Automation complacency**						
LO	State the main weaknesses in the monitoring of automatic systems.	x	x	x	x	x	x
LO	Explain the following terms in connection with automatic systems: passive monitoring; blinkered concentration; confusion; mode awareness.	x	x	x	x	x	x
LO	Give examples of actions which may be taken to counteract ineffective monitoring of automatic systems.	x	x	x	x	x	x

LO	Define 'complacency'.	x	x	x	x	x	x
040 03 07 03	**Working concepts**						
LO	Analyse the influence of automation on crew communication and describe the potential disadvantages.	x		x	x		
LO	Summarise how the negative effects of automation on pilots may be alleviated.	x	x	x	x	x	x
LO	Interpret the role of automation with respect to flight safety.	x	x	x	x	x	x

I. SUBJECT 050 — METEOROLOGY

The operation of an aircraft is affected by the weather conditions within the atmosphere. The pilot must prove that they fulfil the following objectives in order to complete a safe flight in given meteorological conditions.

(1) Training aims

(i) Knowledge. After completion of the training, the pilot must be able to:

— understand the physical processes in the atmosphere;

— interpret the actual and forecast weather conditions in the atmosphere;

— show understanding of the meteorological hazards and their effects on an aircraft.

(ii) Skills. After completion of the training, the pilot must be able to:

— collect all the weather information which may affect a given flight;

— analyse and evaluate available weather information before flight as well as that collected in flight;

— apply a solution to any problems presented by weather conditions.

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 00 00 00	**METEOROLOGY**						
050 01 00 00	**THE ATMOSPHERE**						
050 01 01 00	**Composition, extent, vertical division**						

050 01 01 01	**Structure of the atmosphere**						
LO	Describe the vertical division of the atmosphere, based on the temperature variations with height.	x	x	x	x	x	x
LO	List the different layers and their main qualitative characteristics.	x	x	x	x	x	x
050 01 01 02	**Troposphere**						
LO	Describe the troposphere.	x	x	x	x	x	x
LO	Describe the main characteristics of the tropopause.	x	x	x	x	x	x
LO	Describe the proportions of the most important gases in the air in the troposphere.	x	x	x	x	x	x
LO	Describe the variations of the flight level and temperature of the tropopause from the poles to the equator.	x	x	x	x	x	x
LO	Describe the breaks in the tropopause along the boundaries of the main air masses.	x	x	x	x	x	x
LO	Indicate the variations of the flight level of the tropopause with the seasons and the variations of atmospheric pressure.	x		x	x		
050 01 01 03	**Stratosphere**						
LO	Describe the stratosphere.	x		x	x		
LO	Describe the main differences of the composition of the air in the stratosphere compared to the troposphere.	x		x	x		
LO	Mention the vertical extent of the stratosphere up to the stratopause.	x		x	x		
LO	Describe the reason for the temperature increase in the ozone layer.	x		x	x		
050 01 02 00	**Air temperature**						
050 01 02 01	**Definition and units**						
LO	Define 'air temperature'.	x	x	x	x	x	x
LO	List the units of measurement of air temperature used in aviation meteorology (Celsius, Fahrenheit, Kelvin). (Refer to 050 10 01 01)	x	x	x	x	x	x
050 01 02 02	**Vertical distribution of temperature**						
LO	Describe the mean vertical distribution of temperature up to 20 km.	x	x	x	x	x	x

LO	Mention the general causes of the cooling of the air in the troposphere with increasing altitude.	x	x	x	x	x	x
LO	Calculate the temperature and temperature deviations at specified levels.	x	x	x	x	x	x
050 01 02 03	**Transfer of heat**						
LO	Explain how local cooling or warming processes result in transfer of heat.	x	x	x	x	x	x
LO	Describe radiation.	x	x	x	x	x	x
LO	Describe solar radiation reaching the Earth.	x	x	x	x	x	x
LO	Describe the filtering effect of the atmosphere on solar radiation.	x	x	x	x	x	x
LO	Describe terrestrial radiation.	x	x	x	x	x	x
LO	Explain how terrestrial radiation is absorbed by some components of the atmosphere.	x	x	x	x	x	x
LO	Explain the greenhouse effect due to water vapour and some other gases in the atmosphere.	x	x	x	x	x	x
LO	Explain the effect of absorption and radiation in connection with clouds.	x	x	x	x	x	x
LO	Explain the process of conduction.	x	x	x	x	x	x
LO	Explain the role of conduction in the cooling and warming of the atmosphere.	x	x	x	x	x	x
LO	Explain the process of convection.	x	x	x	x	x	x
LO	Name the situations in which convection occurs.	x	x	x	x	x	x
LO	Explain the process of advection.	x	x	x	x	x	x
LO	Name the situations in which advection occurs.	x	x	x	x	x	x
LO	Describe the transfer of heat by turbulence.	x	x	x	x	x	x
LO	Describe the transfer of latent heat.	x	x	x	x	x	x
050 01 02 04	Lapse rates						
LO	Describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value 0.65 °C/100 m or 2 °C/1 000 ft and actual values).	x	x	x	x	x	x
050 01 02 05	Development of inversions, types of inversions						
LO	Describe the development and types of inversions.	x	x	x	x	x	x
LO	Explain the characteristics of inversions and of an isothermal layer.	x	x	x	x	x	x

LO	Explain the reasons for the formation of the following inversions: ground inversion (nocturnal radiation/ advection), subsidence inversion, frontal inversion, inversion above friction layer, valley inversion.	x	x	x	x	x	x
LO	Explain the reasons for the formation of the following inversions: tropopause inversion.	x		x	x		
050 01 02 06	Temperature near the Earth's surface, surface effects, diurnal and seasonal variation, effect of clouds, effect of wind						
LO	Describe how the temperature near the Earth's surface is influenced by seasonal variations.	x	x	x	x	x	x
LO	Explain the cooling and warming of the air on the earth or sea surfaces.	x	x	x	x	x	x
LO	Sketch the diurnal variation of the temperature of the air in relation to the radiation of the sun and of the Earth.	x	x	x	x	x	x
LO	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface.	x	x	x	x	x	x
LO	Distinguish between the influence of low or high clouds and thick or thin clouds.	x	x	x	x	x	x
LO	Explain the influence of the wind on the cooling and warming of the air near the surfaces.	x	x	x	x	x	x
050 01 03 00	Atmospheric pressure						
050 01 03 01	Barometric pressure, isobars						
LO	Define 'atmospheric pressure'.	x	x	x	x	x	x
LO	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches). (Refer to 050 10 01 01)	x	x	x	x	x	x
LO	Describe the principle of the barometers (mercury barometer, aneroid barometer).	x	x	x	x	x	x
LO	Describe isobars on surface weather charts.	x	x	x	x	x	x
LO	Define 'high', 'low', 'trough', 'ridge', 'wedge', 'col'.	x	x	x	x	x	x
050 01 03 02	Pressure variation with height, contours (isohypses)						
LO	Explain the pressure variation with height.	x	x	x	x	x	x

LO	Describe qualitatively the variation of the barometric lapse rate. Remark: The average value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa, at about 5 500 m/AMSL is 50 ft (15 m) per 1 hPa.	x	x	x	x	x	x
LO	Describe and interpret contour lines (isohypses) on a constant pressure chart. (Refer to 050 10 02 03)	x	x	x	x	x	x
050 01 03 03	Reduction of pressure to mean sea level, QFF						
LO	Define 'QFF'.	x	x	x	x	x	x
LO	Explain the reduction of measured pressure to mean sea level, QFF.	x	x	x	x	x	x
LO	Mention the use of QFF for surface weather charts.	x	x	x	x	x	x
050 01 03 04	Relationship between surface pressure centres and pressure centres aloft						
LO	Illustrate with a vertical cross section of isobaric surfaces the relationship between surface pressure systems and upper-air pressure systems.	x	x	x	x	x	x
050 01 04 00	Air density						
050 01 04 01	Relationship between pressure, temperature and density						
LO	Describe the relationship between pressure, temperature and density.	x	x	x	x	x	x
LO	Describe the vertical variation of the air density in the atmosphere.	x	x	x	x	x	x
LO	Describe the effect of humidity changes on the density of air.	x	x	x	x	x	x
050 01 05 00	**ICAO Standard Atmosphere (ISA)**						
050 01 05 01	**ICAO Standard Atmosphere (ISA)**						
LO	Explain the use of standardised values for the atmosphere.	x	x	x	x	x	x
LO	List the main values of the ISA (mean sea-level pressure, mean sea-level temperature, the vertical temperature lapse rate up to 20 km, height and temperature of the tropopause).	x	x	x	x	x	x
LO	Calculate the standard temperature in Celsius for a given flight level.	x	x	x	x	x	x

LO	Determine a standard temperature deviation by the difference between the given outside-air temperature and the standard temperature.	x	x	x	x	x	x
050 01 06 00	**Altimetry**						
050 01 06 01	**Terminology and definitions**						
LO	Define the following terms and acronyms and explain how they are related to each other: height, altitude, pressure altitude, flight level, level, true altitude, true height, elevation, QNH, QFE, and standard altimeter setting.	x	x	x	x	x	x
LO	Describe the terms ‘transition altitude’, ‘transition level’, ‘transition layer’, ‘terrain clearance’, ‘lowest usable flight level’.	x	x	x	x	x	x
050 01 06 02	**Altimeter settings**						
LO	Name the altimeter settings associated to height, altitude, pressure altitude and flight level.	x	x	x	x	x	x
LO	Describe the altimeter-setting procedures.	x	x	x	x	x	x
050 01 06 03	**Calculations**						
LO	Calculate the different readings on the altimeter when the pilot changes the altimeter setting.	x	x	x	x	x	x
LO	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level.	x	x	x	x	x	x
LO	Derive the reading of the altimeter of an aircraft on the ground when the pilot uses the different settings.	x	x	x	x	x	x
LO	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two flight levels.	x	x	x	x	x	x
LO	Explain the influence of pressure areas on true altitude.	x	x	x	x	x	x
LO	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation.	x	x	x	x	x	x
LO	Calculate the terrain clearance and the lowest usable flight level for given atmospheric temperature and pressure conditions.	x	x	x	x	x	x

	Remark: The following rules shall be considered for altimetry calculations: a) All calculations are based on rounded pressure values to the nearest lower hPa; b) The value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa; c) To determine the true altitude/height, the following rule of thumb, called the '4 %-rule', shall be used: the altitude/height changes by 4 % for each 10 °C temperature deviation from ISA; d) If no further information is given, the deviation of outside-air temperature from ISA is considered to be constantly the same given value in the whole layer; e) The elevation of the airport has to be taken into account. The temperature correction has to be considered for the layer between ground and the position of the aircraft.						
050 01 06 04	**Effect of accelerated airflow due to topography**						
LO	Describe qualitatively how the effect of accelerated airflow due to topography (Bernoulli effect) affects altimetry.	x	x	x	x	x	x
050 02 00 00	**WIND**						
050 02 01 00	**Definition and measurement of wind**						
050 02 01 01	**Definition and measurement**						
LO	Define 'wind'.	x	x	x	x	x	x
LO	State the units of wind direction and speed (kt, m/s, km/h). (Refer to 050 10 01 01)	x	x	x	x	x	x
LO	Explain how wind is measured in meteorology.	x	x	x	x	x	x
050 02 02 00	**Primary cause of wind**						
050 02 02 01	**Primary cause of wind, pressure gradient, Coriolis force, gradient wind**						
LO	Define the term 'horizontal pressure gradient'.	x	x	x	x	x	x
LO	Explain how the pressure gradient force acts in relation to the pressure gradient.	x	x	x	x	x	x
LO	Explain how the Coriolis force acts in relation to the wind.	x	x	x	x	x	x
LO	Explain the development of the geostrophic wind.	x	x	x	x	x	x

<table>
<tr><td>LO</td><td>Indicate how the geostrophic wind flows in relation to the isobars/isohypses in the northern and in the southern hemisphere.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Analyse the effect of changing latitude on the geostrophic-wind speed.</td><td>x</td><td></td><td>x</td><td>x</td><td></td><td></td></tr>
<tr><td>LO</td><td>Explain the gradient wind effect and indicate how the gradient wind differs from the geostrophic wind in cyclonic and anticyclonic circulation.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>050 02 02 02</td><td>Variation of wind in the friction layer</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>LO</td><td>Describe why and how the wind changes direction and speed with height in the friction layer in the northern and in the southern hemisphere (rule of thumb).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>State the surface and air-mass conditions that influence the wind in the friction layer (diurnal variation).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Name the factors that influence the vertical extent of the friction layer.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Explain the relationship between isobars and wind (direction and speed).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td></td><td>Remark: Approximate value for variation of wind in the friction layer (values to be used in examinations):
<table>
<tr><td>Type of landscape</td><td>Wind speed in friction layer in % of the geostrophic wind</td><td>The wind in the friction layer blows across the isobars towards the low pressure. Angle between wind direction and isobars.</td></tr>
<tr><td>over water</td><td>ca 70 %</td><td>ca 10°</td></tr>
<tr><td>over land</td><td>ca 50 %</td><td>ca 30°</td></tr>
</table>
WMO-NO. 266</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>050 02 02 03</td><td>Effects of convergence and divergence</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>LO</td><td>Describe atmospheric convergence and divergence.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Explain the effect of convergence and divergence on the following: pressure systems at the surface and aloft; wind speed; vertical motion and cloud formation (relationship between upper-air conditions and surface pressure systems).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>050 02 03 00</td><td>General global circulation</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

050 02 03 01	**General circulation around the globe**						
LO	Describe and explain the general global circulation. (Refer to 050 08 01 01)	x	x	x	x	x	x
LO	Name and sketch or indicate on a map the global distribution of the surface pressure and the resulting wind pattern for all latitudes at low level in January and July.	x		x	x		
LO	Sketch or indicate on a map the westerly and easterly tropospheric winds at high level in January and July.	x		x	x		
050 02 04 00	**Local winds**						
050 02 04 01	**Anabatic and katabatic winds, mountain and valley winds, Venturi effects, land and sea breezes**						
LO	Describe and explain anabatic and katabatic winds.	x	x	x	x	x	x
LO	Describe and explain mountain and valley winds.	x	x	x	x	x	x
LO	Describe and explain the Venturi effect, convergence in valleys and mountain areas.	x	x	x	x	x	x
LO	Describe and explain land and sea breezes, sea-breeze front.	x	x	x	x	x	x
050 02 05 00	**Mountain waves (standing waves, lee waves)**						
050 02 05 01	**Origin and characteristics**						
LO	Describe and explain the origin and formation of mountain waves.	x	x	x	x	x	x
LO	State the conditions necessary for the formation of mountain waves.	x	x	x	x	x	x
LO	Describe the structure and properties of mountain waves.	x	x	x	x	x	x
LO	Explain how mountain waves may be identified by their associated meteorological phenomena.	x	x	x	x	x	x
050 02 06 00	**Turbulence**						
050 02 06 01	**Description and types of turbulence**						
LO	Describe turbulence and gustiness.	x	x	x	x	x	x
LO	List the common types of turbulence (convective, mechanical, orographic, frontal, clear-air turbulence).	x	x	x	x	x	x
050 02 06 02	**Formation and location of turbulence**						

LO	Explain the formation of convective turbulence, mechanical and orographic turbulence, frontal turbulence, clear-air turbulence. (Refer to 050 02 06 03)	x	x	x	x	x	x
LO	State where turbulence will normally be found (rough-ground surfaces, relief, inversion layers, CB, TS zones, unstable layers).	x	x	x	x	x	x
050 02 06 03	**Clear-Air Turbulence (CAT): Description, cause and location**						
LO	Describe the term CAT.	x	x	x	x	x	x
LO	Explain the formation of CAT. (Refer to 050 02 06 02)	x	x	x	x	x	x
LO	State where CAT is found in association with jet streams, in high-level troughs and in other disturbed high-level air flows. (Refer to 050 09 02 02)	x		x	x		
050 02 07 00	**Jet streams**						
050 02 07 01	**Description**						
LO	Describe jet streams.	x	x	x	x	x	x
LO	State the defined minimum speed of a jet stream.	x	x	x	x	x	x
LO	State the typical figures for the dimensions of jet streams.	x	x	x	x	x	x
050 02 07 02	**Formation and properties of jet streams**						
LO	Explain the formation and state the heights, the speeds, the seasonal variations of speeds, the geographical positions, the seasonal occurrence and the seasonal movements of the arctic (front) jet stream, the polar front jet stream, the subtropical jet stream, and the tropical (easterly/ equatorial) jet stream.	x		x	x		
050 02 07 03	**Location of jet streams and associated CAT areas**						
LO	Sketch or describe where polar front and arctic jet streams are found in the troposphere in relation to the tropopause and to fronts.	x		x	x		
LO	Sketch or describe the isotherms, the isotachs, the pressure surfaces and the movements of air in a cross section of a polar front jet stream.	x		x	x		
LO	Describe and indicate the areas of worst wind shear and CAT.	x		x	x		

050 02 07 04	**Jet stream recognition**						
LO	State how jet streams may be recognised from their associated meteorological phenomena.	x		x	x		
050 03 00 00	**THERMODYNAMICS**						
050 03 01 00	**Humidity**						
050 03 01 01	**Water vapour in the atmosphere**						
LO	Describe humid air.	x	x	x	x	x	x
LO	Describe the significance for meteorology of water vapour in the atmosphere.	x	x	x	x	x	x
LO	Indicate the sources of atmospheric humidity.	x	x	x	x	x	x
050 03 01 02	**Mixing ratio**						
LO	Define 'mixing ratio' and 'saturation mixing ratio'.	x	x	x	x	x	x
LO	Name the unit used in meteorology to express the mixing ratio (g/kg).	x	x	x	x	x	x
LO	Explain the factors influencing the mixing ratio.	x	x	x	x	x	x
LO	Recognise the lines of equal mixing ratio on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Define 'saturation of air by water vapour'.	x	x	x	x	x	x
LO	Illustrate with a diagram (T, mixing ratio) the influence of the temperature on the saturation mixing ratio, at constant pressure.	x	x	x	x	x	x
LO	Explain the influence of the pressure on the saturation mixing ratio. Remark: A simplified diagram (T,P) contains: on the x-axis: temperature (T); on the y-axis: height corresponding to pressure (P). The degree of saturation/mixing ratio and stability/instability are shown as functions of temperature change with height (as lines or curves in the diagram).	x	x	x	x	x	x
050 03 01 03	**Temperature/dew point, relative humidity**						
LO	Define 'dew point'.	x	x	x	x	x	x
LO	Recognise the dew-point curve on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Define 'relative humidity'.	x	x	x	x	x	x

LO	Explain the factors influencing the relative humidity at constant pressure.	x	x	x	x	x	x
LO	Explain the diurnal variation of the relative humidity.	x	x	x	x	x	x
LO	Describe the relationship between relative humidity, the amount of water vapour and the temperature.	x	x	x	x	x	x
LO	Describe the relationship between temperature and dew point.	x	x	x	x	x	x
LO	Estimate the relative humidity of the air from the difference between dew point and temperature.	x	x	x	x	x	x
050 03 02 00	**Change of state of aggregation**						
050 03 02 01	**Condensation, evaporation, sublimation, freezing and melting, latent heat**						
LO	Define 'condensation', 'evaporation', 'sublimation', 'freezing and melting' and 'latent heat'.	x	x	x	x	x	x
LO	List the conditions for condensation/ evaporation.	x	x	x	x	x	x
LO	Explain the condensation process.	x	x	x	x	x	x
LO	Explain the nature of and the need for condensation nuclei.	x	x	x	x	x	x
LO	Explain the effects of condensation on the weather.	x	x	x	x	x	x
LO	List the conditions for freezing/melting.	x	x	x	x	x	x
LO	Explain the process of freezing.	x	x	x	x	x	x
LO	Explain the nature of and the need for freezing nuclei.	x	x	x	x	x	x
LO	Define 'supercooled water'. (Refer to 050 09 01 01)	x	x	x	x	x	x
LO	List the conditions for sublimation.	x	x	x	x	x	x
LO	Explain the sublimation process.	x	x	x	x	x	x
LO	Explain the nature of and the need for sublimation nuclei.	x	x	x	x	x	x
LO	Describe the absorption or release of latent heat in each change of state of aggregation.	x	x	x	x	x	x
LO	Explain the influence of atmospheric pressure, the temperature of the air and of the water or ice on the changes of state of aggregation.	x	x	x	x	x	x
LO	Illustrate all the changes of state of aggregation with practical examples.	x	x	x	x	x	x
050 03 03 00	**Adiabatic processes**						

050 03 03 01	**Adiabatic processes, stability of the atmosphere**						
LO	Describe the adiabatic processes.	x	x	x	x	x	x
LO	Describe the adiabatic process in an unsaturated rising or descending air particle.	x	x	x	x	x	x
LO	Explain the variation of temperature with changing altitude.	x	x	x	x	x	x
LO	Explain the changes which take place in mixing ratio with changing altitude.	x	x	x	x	x	x
LO	Explain the changes which take place in relative humidity with changing altitude.	x	x	x	x	x	x
LO	Use the dry-adiabatic and mixing-ratio lines on a simplified diagram (T, P) for a climbing or descending air particle.	x	x	x	x	x	x
LO	Describe the adiabatic process in a saturated rising or descending air particle.	x	x	x	x	x	x
LO	Explain the variation of temperature with changing altitude.	x	x	x	x	x	x
LO	Explain the difference in temperature lapse rate between saturated and unsaturated air.	x	x	x	x	x	x
LO	Explain the influence of different air temperatures on the temperature lapse rate in saturated air.	x	x	x	x	x	x
LO	Use the saturated adiabatic lines on a simplified diagram (T, P) for a climbing or descending air particle.	x	x	x	x	x	x
LO	Find the condensation level, or base of the clouds, on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Explain the static stability of the atmosphere with reference to the adiabatic lapse rates.	x	x	x	x	x	x
LO	Define qualitatively and quantitatively the terms ‘stability’, ‘conditional instability’, ‘instability’ and ‘indifferent (neutral)’.	x	x	x	x	x	x
LO	Explain with a sketch on a simplified diagram (T, P) the different possibilities of atmospheric stability: absolute stability, absolute instability, conditional instability and indifferent (neutral).	x	x	x	x	x	x
LO	Illustrate with a sketch of the adiabatic lapse rates and the vertical temperature profile of the atmosphere the effect of an inversion on the vertical motion of air.	x	x	x	x	x	x

LO	Illustrate with a schematic sketch of the saturated adiabatic lapse rate and the vertical temperature profile the instability inside a cumuliform cloud.	x	x	x	x	x	x
LO	Illustrate with a schematic sketch the formation of the subsidence inversion.	x	x	x	x	x	x
LO	Illustrate with a schematic sketch the formation of Foehn.	x	x	x	x	x	x
LO	Explain the effect on the stability of the air caused by advection of air (warm or cold). Remark: Dry adiabatic lapse rate = 1 °C/100 m or 3 °C/1 000 ft; average value at lower levels for saturated adiabatic lapse rate = 0.6 °C/100 m or 1.8 °C/1 000 ft (values to be used in examinations).	x	x	x	x	x	x
050 04 00 00	**CLOUDS AND FOG**						
050 04 01 00	**Cloud formation and description**						
050 04 01 01	**Cloud formation**						
LO	Explain cloud formation by adiabatic cooling, conduction, advection and radiation.	x	x	x	x	x	x
LO	Describe cloud formation based on the following lifting processes: unorganised lifting in thin layers and turbulent mixing; forced lifting at fronts or over mountains; free convection.	x	x	x	x	x	x
LO	Determine cloud base and top in a simplified diagram (temperature, pressure, humidity).	x	x	x	x	x	x
LO	Explain the influence of relative humidity on the height of the cloud base.	x	x	x	x	x	x
LO	Illustrate in a thermodynamic diagram the meaning of convective temperature (temperature at which formation of cumulus starts).	x	x	x	x	x	x
LO	List cloud types typical for stable and unstable air conditions.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of clouds.	x	x	x	x	x	x
050 04 01 02	**Cloud types and cloud classification**						
LO	Describe cloud types and cloud classification.	x	x	x	x	x	x
LO	Identify by shape cirriform, cumuliform and stratiform clouds.	x	x	x	x	x	x
LO	Identify by shape and typical level the 10 cloud types (genera).	x	x	x	x	x	x

LO	Describe and identify by shape the following species and supplementary feature: castellanus, lenticularis, fractus, humilis, mediocris, congestus, calvus, capillatus and virga.	x	x	x	x	x	x
LO	Distinguish between low, medium and high-level clouds according to the WMO 'cloud etage' (including heights): for mid latitudes.	x	x	x	x	x	x
LO	Distinguish between low, medium and high-level clouds according to the WMO 'cloud etage' (including heights): for all latitudes.	x		x	x		
LO	Distinguish between ice clouds, mixed clouds and pure-water clouds.	x	x	x	x	x	x
050 04 01 03	**Influence of inversions on cloud development**						
LO	Explain the influence of inversions on vertical movements in the atmosphere.	x	x	x	x	x	x
LO	Explain the influence of an inversion on the formation of stratus clouds.	x	x	x	x	x	x
LO	Explain the influence of ground inversion on the formation of fog.	x	x	x	x	x	x
LO	Determine on a simplified diagram the top of a cumulus cloud caused by an inversion.	x	x	x	x	x	x
LO	Describe the role of the tropopause inversion with regard to the formation of clouds.	x		x	x		
050 04 01 04	**Flying conditions in each cloud type**						
LO	Assess the 10 cloud types for icing and turbulence.	x	x	x	x	x	x
050 04 02 00	**Fog, mist, haze**						
050 04 02 01	**General aspects**						
LO	Define 'fog', 'mist' and 'haze' with reference to the WMO standards of visibility range.	x	x	x	x	x	x
LO	Explain the formation of fog, mist and haze in general.	x	x	x	x	x	x
LO	Name the factors contributing in general to the formation of fog and mist.	x	x	x	x	x	x
LO	Name the factors contributing to the formation of haze.	x	x	x	x	x	x
LO	Describe freezing fog and ice fog.	x	x	x	x	x	x
050 04 02 02	**Radiation fog**						

LO	Explain the formation of radiation fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of radiation fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of radiation fog, and its vertical extent.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of radiation fog.	x	x	x	x	x	x
050 04 02 03	**Advection fog**						
LO	Explain the formation of advection fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of advection fog.	x	x	x	x	x	x
LO	Describe the different possibilities of advection-fog formation (over land, sea and coastal regions).	x	x	x	x	x	x
LO	Describe the significant characteristics of advection fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of advection fog.	x	x	x	x	x	x
050 04 02 04	**Steam fog**						
LO	Explain the formation of steam fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of steam fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of steam fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of steam fog.	x	x	x	x	x	x
050 04 02 05	**Frontal fog**						
LO	Explain the formation of frontal fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of frontal fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of frontal fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of frontal fog.	x	x	x	x	x	x
050 04 02 06	**Orographic fog (hill fog)**						
LO	Summarise the features of orographic fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of orographic fog.	x	x	x	x	x	x

LO	Describe the significant characteristics of orographic fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of orographic fog.	x	x	x	x	x	x
050 05 00 00	**PRECIPITATION**						
050 05 01 00	**Development of precipitation**						
050 05 01 01	**Process of development of precipitation**						
LO	Distinguish between the two following processes by which precipitation is formed.	x	x	x	x	x	x
LO	Summarise the outlines of the ice-crystal process (Wegener-Bergeron-Findeisen).	x	x	x	x	x	x
LO	Summarise the outlines of the coalescence process.	x	x	x	x	x	x
LO	Describe the atmospheric conditions that favour either process.	x	x	x	x	x	x
LO	Explain the development of snow, rain, drizzle and hail.	x	x	x	x	x	x
050 05 02 00	**Types of precipitation**						
050 05 02 01	**Types of precipitation, relationship with cloud types**						
LO	List and describe the types of precipitation given in the TAF and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, freezing rain).	x	x	x	x	x	x
LO	State the ICAO/WMO approximate diameters for cloud, drizzle and rain drops.	x	x	x	x	x	x
LO	State the approximate weights and diameters for hailstones.	x	x	x	x	x	x
LO	Explain the mechanism for the formation of freezing precipitation.	x	x	x	x	x	x
LO	Describe the weather conditions that give rise to freezing precipitation.	x	x	x	x	x	x
LO	Distinguish between the types of precipitation generated in convective and stratiform cloud.	x	x	x	x	x	x
LO	Assign typical precipitation types and intensities to different clouds.	x	x	x	x	x	x
050 06 00 00	**AIR MASSES AND FRONTS**						
050 06 01 00	**Air masses**						
050 06 01 01	**Description, classification and source regions of air masses**						

LO	Define the term 'air mass'.	x	x	x	x	x	x
LO	Describe the properties of the source regions.	x	x	x	x	x	x
LO	Summarise the classification of air masses by source regions.	x	x	x	x	x	x
LO	State the classifications of air masses by temperature and humidity at source.	x	x	x	x	x	x
LO	State the characteristic weather in each of the air masses.	x	x	x	x	x	x
LO	Name the three main air masses that affect Europe.	x	x	x	x	x	x
LO	Classify air masses on a surface weather chart.	x	x	x	x	x	x
	Remark: Names and abbreviations of air masses used in examinations: first letter: humidity continental (c), maritime (m), second letter: type of air mass Arctic (A), Polar (P), Tropical (T), Equatorial (E), third letter: temperature cold (c), warm (w).						
050 06 01 02	**Modifications of air masses**						
LO	List the environmental factors that affect the final properties of an air mass.	x	x	x	x	x	x
LO	Explain how maritime and continental tracks modify air masses.	x	x	x	x	x	x
LO	Explain the effect of passage over cold or warm surfaces.	x	x	x	x	x	x
LO	Explain how air-mass weather is affected by the season, the air-mass track and by orographic and thermal effects over land.	x	x	x	x	x	x
LO	Assess the tendencies of the stability for an air mass and describe the typical resulting air-mass weather including the hazards for aviation.	x	x	x	x	x	x

050 06 02 00	**Fronts**						
050 06 02 01	**General aspects**						
LO	Describe the boundaries between air masses (fronts).	x	x	x	x	x	x
LO	Define ‘front and frontal surface (frontal zone)’.	x	x	x	x	x	x
LO	Name the global frontal systems (polar front, arctic front).	x	x	x	x	x	x
LO	State the approximate seasonal latitudes and geographic positions of the polar front and the arctic front.	x	x	x	x	x	x
050 06 02 02	**Warm front, associated clouds and weather**						
LO	Define a ‘warm front’.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at warm fronts.	x	x	x	x	x	x
LO	Describe the structure, slope and dimensions of a warm front.	x	x	x	x	x	x
LO	Sketch a cross section of a warm front showing weather, cloud and aviation hazards.	x	x	x	x	x	x
050 06 02 03	**Cold front, associated clouds and weather**						
LO	Define a ‘cold front’.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at cold fronts.	x	x	x	x	x	x
LO	Describe the structure, slope and dimensions of a cold front.	x	x	x	x	x	x
LO	Sketch a cross section of a cold front showing weather, cloud and aviation hazards.	x	x	x	x	x	x
050 06 02 04	**Warm sector, associated clouds and weather**						
LO	Define ‘fronts and air masses associated with the warm sector’.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather in the warm sector.	x	x	x	x	x	x

LO	Sketch a cross section of a warm sector showing weather, cloud and aviation hazards.	x	x	x	x	x	x
050 06 02 05	**Weather behind the cold front**						
LO	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather behind the cold front.	x	x	x	x	x	x
050 06 02 06	**Occlusions, associated clouds and weather**						
LO	Define the term ‘occlusion’.	x	x	x	x	x	x
LO	Define a ‘cold occlusion’.	x	x	x	x	x	x
LO	Define a ‘warm occlusion’.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at occlusions.	x	x	x	x	x	x
LO	Sketch a cross section of cold and warm occlusions showing weather, cloud and aviation hazards.	x	x	x	x	x	x
LO	On a sketch illustrate the development of an occlusion and the movement of the occlusion point.	x	x	x	x	x	x
050 06 02 07	**Stationary front, associated clouds and weather**						
LO	Define a ‘stationary or quasi-stationary front’.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a stationary or quasi-stationary front.	x	x	x	x	x	x
050 06 02 08	**Movement of fronts and pressure systems, life cycle**						
LO	Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression.	x	x	x	x	x	x
LO	State the rules for predicting the direction and the speed of movement of fronts.	x	x	x	x	x	x
LO	Explain the difference between the speed of movement of cold and warm fronts.	x	x	x	x	x	x
LO	State the rules for predicting the direction and the speed of movement of frontal depressions.	x	x	x	x	x	x

LO	Describe, with a sketch if required, the genesis, development and life cycle of a frontal depression with associated cloud and rain belts.	x	x	x	x	x	x
050 06 02 09	**Changes of meteorological elements at a frontal wave**						
LO	Sketch a plan and a cross section of a frontal wave (warm front, warm sector and cold front) and illustrate the changes of pressure, temperature, surface wind and wind in the vertical axis.	x	x	x	x	x	x
050 07 00 00	**PRESSURE SYSTEMS**						
050 07 01 00	**The principal pressure areas**						
050 07 01 01	**Location of the principal pressure areas**						
LO	Identify or indicate on a map the principal global high-pressure and low-pressure areas in January and July.	x		x	x		
LO	Explain how these pressure areas are formed.	x		x	x		
LO	Explain how the pressure areas move with the seasons.	x		x	x		
050 07 02 00	**Anticyclone**						
050 07 02 01	**Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence**						
LO	List the different types of anticyclones.	x	x	x	x	x	x
LO	Describe the effect of high-level convergence in producing areas of high pressure at ground level.	x	x	x	x	x	x
LO	Describe air-mass subsidence, its effect on the environmental lapse rate, and the associated weather.	x	x	x	x	x	x
LO	Describe the formation of warm and cold anticyclones.	x	x	x	x	x	x
LO	Describe the formation of ridges and wedges. (Refer to 050 08 03 02)	x	x	x	x	x	x
LO	Describe the properties of and the weather associated with warm and cold anticyclones.	x	x	x	x	x	x
LO	Describe the properties of and the weather associated with ridges and wedges.	x	x	x	x	x	x
LO	Describe the blocking anticyclone and its effects.	x	x	x	x	x	x
050 07 03 00	**Non-frontal depressions**						
050 07 03 01	**Thermal, orographic, polar and secondary depressions; troughs**						

LO	Describe the effect of high-level divergence in producing areas of low pressure at ground level.	x	x	x	x	x	x
LO	Describe the formation and properties of thermal, orographic (lee lows), polar and secondary depressions.	x	x	x	x	x	x
LO	Describe the formation, the properties and the associated weather of troughs.	x	x	x	x	x	x
050 07 04 00	**Tropical revolving storms**						
050 07 04 01	**Characteristics of tropical revolving storms**						
LO	State the conditions necessary for the formation of tropical revolving storms.	x		x	x		
LO	Explain how a tropical revolving storm moves during its life cycle.	x		x	x		
LO	Name the stages of the development of tropical revolving storms (tropical disturbance, tropical depression, tropical storm, severe tropical storm, tropical revolving storm).	x		x	x		
LO	Describe the meteorological conditions in and near a tropical revolving storm.	x		x	x		
LO	State the approximate dimensions of a tropical revolving storm.	x		x	x		
050 07 04 02	**Origin and local names, location and period of occurrence**						
LO	List the areas of origin and occurrence of tropical revolving storms, and their specified names (hurricane, typhoon, tropical cyclone).	x		x	x		
LO	State the expected times of occurrence of tropical revolving storms in each of the source areas, and their approximate frequency.	x		x	x		
050 08 00 00	**CLIMATOLOGY**						
050 08 01 00	**Climatic zones**						
050 08 01 01	**General circulation in the troposphere and lower stratosphere**						
LO	Describe the general tropospheric and low stratospheric circulation. (Refer to 050 02 03 01)	x		x	x		
050 08 01 02	**Climatic classification**						
LO	Name the world climate groups according to Koeppen's classification.	x		x	x		

LO	Describe the characteristics of the tropical rain climate, the dry climate, the mid-latitude climate (warm temperate rain climate), the subarctic climate (cold snow-forest climate) and the snow climate (polar climate).	x		x	x		
LO	Explain how the seasonal movement of the sun generates the transitional climate zones.	x		x	x		
LO	Describe the typical weather in the tropical transitional climate (savannah climate) and in the temperate transitional climate (Mediterranean climate).	x		x	x		
LO	State the typical locations of each major climatic zone.	x		x	x		
050 08 02 00	**Tropical climatology**						
050 08 02 01	**Cause and development of tropical showers and thunderstorms: humidity, temperature, tropopause**						
LO	State the conditions necessary for the formation of tropical rain showers and thunderstorms (mesoscale convective complex, cloud clusters).	x		x	x		
LO	Describe the characteristics of tropical squall lines.	x		x	x		
LO	Explain the formation of convective cloud structures caused by convergence at the boundary of the NE and SE trade winds (Intertropical Convergence Zone (ITCZ)).	x		x	x		
LO	State the typical figures for tropical surface air temperatures and humidities, and heights of the zero-degree isotherm.	x		x	x		
050 08 02 02	**Seasonal variations of weather and wind, typical synoptic situations**						
LO	Describe the seasonal variations of weather and winds, and describe the typical synoptic situations.	x		x	x		
LO	Indicate on a map the trade winds (tropical easterlies) and describe the associated weather.	x		x	x		
LO	Indicate on a map the doldrums and describe the associated weather.	x		x	x		
LO	Indicate on a sketch the latitudes of subtropical high (horse latitudes) and describe the associated weather.	x		x	x		
LO	Indicate on a map the major monsoon winds. (Refer to 050 08 02 04 for a description of the weather)	x		x	x		

050 08 02 03	**Intertropical Convergence Zone (ITCZ), weather in the ITCZ, general seasonal movement**						
LO	Identify or indicate on a map the positions of the ITCZ in January and July.	x		x	x		
LO	Explain the seasonal movement of the ITCZ.	x		x	x		
LO	Describe the weather and winds at the ITCZ.	x		x	x		
LO	Explain the variations in weather that are found at the ITCZ.	x		x	x		
LO	Explain the flight hazards associated with the ITCZ.	x		x	x		
050 08 02 04	**Monsoon, sandstorms, cold-air outbreaks**						
LO	Define in general the term 'monsoon'.	x		x	x		
LO	Describe the major monsoon conditions. (Refer to 050 08 02 02)	x		x	x		
LO	Explain how trade winds change character after a long track and become monsoon winds.	x		x	x		
LO	Explain the formation of the SW/NE monsoon over West Africa and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Explain the formation of the SW/NE monsoon over India and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Explain the formation of the monsoon over the Far East and northern Australia and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Describe the formation and properties of sandstorms.	x		x	x		
LO	Indicate when and where outbreaks of cold polar air can enter subtropical weather systems.	x		x	x		
LO	Name well-known examples of polar-air outbreaks (Blizzard, Pampero).	x		x	x		
050 08 02 05	**Easterly waves**						
LO	Describe and explain the formation of easterly waves, the associated weather and the duration of the weather activity.	x		x	x		
LO	Describe and explain the global distribution of easterly waves.	x		x	x		
LO	Explain the effect of easterly waves on tropical weather systems.	x		x	x		
050 08 03 00	**Typical weather situations in the mid-latitudes**						

050 08 03 01	**Westerly situation (westerlies)**						
LO	Identify on a weather chart the typical westerly situation with travelling polar front waves.	x	x	x	x	x	x
LO	Describe the typical weather in the region of the travelling polar front waves including the seasonal variations.	x	x	x	x	x	x
LO	State the differences between the northern and the southern hemisphere (roaring forties).	x		x	x		
050 08 03 02	**High-pressure area**						
LO	Describe the high-pressure zones with the associated weather.	x	x	x	x	x	x
LO	Identify on a weather chart the high-pressure regions.	x	x	x	x	x	x
LO	Describe the weather associated with wedges in the polar air. (Refer to 050 07 02 01)	x	x	x	x	x	x
050 08 03 03	**Flat-pressure pattern**						
LO	Identify on a surface weather chart the typical flat-pressure pattern.	x	x	x	x	x	x
LO	Describe the weather associated with a flat-pressure pattern.	x	x	x	x	x	x
050 08 03 04	**Cold-air pool (cold-air drop)**						
LO	Define 'cold-air pool'.	x	x	x	x	x	x
LO	Describe the formation of a cold-air pool.	x	x	x	x	x	x
LO	Describe the characteristics of a cold-air pool with regard to dimensions, duration of life, geographical position, seasons, movements, weather activities and dissipation.	x	x	x	x	x	x
LO	Identify cold-air pools on weather charts.	x	x	x	x	x	x
LO	Explain the problems and dangers of cold-air pools for aviation.	x	x	x	x	x	x
050 08 04 00	**Local winds and associated weather**						
050 08 04 01	**Foehn, Mistral, Bora, Scirocco, Ghibli and Khamsin**						
LO	Describe the classical mechanism for the development of Foehn winds (including Chinook).	x	x	x	x	x	x
LO	Describe the weather associated with Foehn winds.	x	x	x	x	x	x

LO	Describe the formation of, the characteristics of, and the weather associated with the Mistral, the Bora, the Scirocco, the Ghibli and the Khamsin.	x	x	x	x	x	x
050 08 04 02	**Harmattan**						
LO	Describe the Harmattan wind and the associated visibility problems.	x		x	x		
050 09 00 00	**FLIGHT HAZARDS**						
050 09 01 00	**Icing**						
050 09 01 01	**Conditions for ice accretion**						
LO	Summarise the general conditions under which ice accretion occurs on aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle; possibility of sublimation).	x	x	x	x	x	x
LO	Indicate the general weather conditions under which ice accretion in Venturi carburettor occurs.	x	x	x	x	x	x
LO	Explain the general weather conditions under which ice accretion on airframe occurs.	x	x	x	x	x	x
LO	Explain the formation of supercooled water in clouds, rain and drizzle. (Refer to 050 03 02 01)	x	x	x	x	x	x
LO	Explain qualitatively the relationship between the air temperature and the amount of supercooled water.	x	x	x	x	x	x
LO	Explain qualitatively the relationship between the type of cloud and the size and number of the droplets in cumuliform and stratiform clouds.	x	x	x	x	x	x
LO	Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation.	x	x	x	x	x	x
LO	Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, outside clouds and precipitation.	x	x	x	x	x	x
LO	Describe the different factors influencing the intensity of icing: air temperature, amount of supercooled water in a cloud or in precipitation, amount of ice crystals in the air, speed of the aircraft, shape (thickness) of the airframe parts (wings, antennas, etc.).	x	x	x	x	x	x
LO	Explain the effects of topography on icing.	x	x	x	x	x	x

LO	Explain the higher concentration of water drops in stratiform orographic clouds.	x	x	x	x	x	x
050 09 01 02	**Types of ice accretion**						
LO	Define 'clear ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of clear ice.	x	x	x	x	x	x
LO	Explain the formation of the structure of clear ice with the release of latent heat during the freezing process.	x	x	x	x	x	x
LO	Describe the aspect of clear ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Define 'rime ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of rime ice.	x	x	x	x	x	x
LO	Describe the aspects of rime ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Define 'mixed ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of mixed ice.	x	x	x	x	x	x
LO	Describe the aspects of mixed ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Describe the possible process of ice formation in snow conditions.	x	x	x	x	x	x
LO	Define 'hoar frost'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of hoar frost.	x	x	x	x	x	x
LO	Describe the aspects of hoar frost: appearance, solidity.	x	x	x	x	x	x
050 09 01 03	**Hazards of ice accretion, avoidance**						
LO	State the ICAO qualifying terms for the intensity of icing. (See ICAO ATM Doc 4444)	x	x	x	x	x	x
LO	Describe, in general, the hazards of icing.	x	x	x	x	x	x
LO	Assess the dangers of the different types of ice accretion.	x	x	x	x	x	x
LO	Describe the position of the dangerous zones of icing in fronts, in stratiform and cumuliform clouds, and in the different precipitation types.	x	x	x	x	x	x

LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: recognition of the dangerous zones, choice of appropriate track and altitude.	x	x	x	x	x	x
050 09 02 00	**Turbulence**						
050 09 02 01	**Effects on flight, avoidance**						
LO	State the ICAO qualifying terms for the intensity of turbulence. (See ICAO ATM Doc 4444)	x	x	x	x	x	x
LO	Describe the effects of turbulence on an aircraft in flight.	x	x	x	x	x	x
LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: choice of appropriate track and altitude.	x	x	x	x	x	x
050 09 02 02	**Clear-Air Turbulence (CAT): effects on flight, avoidance**						
LO	Describe the effects on flight caused by CAT. (Refer to 050 02 06 03)	x		x	x		
LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: choice of appropriate track and altitude.	x		x	x		
050 09 03 00	**Wind shear**						
050 09 03 01	**Definition of wind shear**						
LO	Define 'wind shear' (vertical and horizontal).	x	x	x	x	x	x
LO	Define 'low-level wind shear'.	x	x	x	x	x	x
050 09 03 02	**Weather conditions for wind shear**						
LO	Describe the conditions, where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief).	x	x	x	x	x	x
050 09 03 03	**Effects on flight, avoidance**						
LO	Describe the effects on flight caused by wind shear.	x	x	x	x	x	x

LO	Indicate the possibilities of avoidance: in the flight planning; during flight.	x	x	x	x	x	x
050 09 04 00	**Thunderstorms**						
050 09 04 01	**Conditions for and process of development, forecast, location, type specification**						
LO	Name the cloud types which indicate the development of thunderstorms.	x	x	x	x	x	x
LO	Describe the different types of thunderstorms, their location, the conditions for and the process of development, and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms).	x	x	x	x	x	x
050 09 04 02	**Structure of thunderstorms, life history**						
LO	Describe and sketch the stages of the life history of a thunderstorm: initial, mature and dissipating stage.	x	x	x	x	x	x
LO	Assess the average duration of thunderstorms and their different stages.	x	x	x	x	x	x
LO	Describe supercell storm: initial, supercell, tornado and dissipating stage.	x	x	x	x	x	x
LO	Summarise the flight hazards of a fully developed thunderstorm.	x	x	x	x	x	x
LO	Indicate on a sketch the most dangerous zones in and around a thunderstorm.	x	x	x	x	x	x
050 09 04 03	**Electrical discharges**						
LO	Describe the basic outline of the electric field in the atmosphere.	x	x	x	x	x	x
LO	Describe the electrical potential differences in and around a thunderstorm.	x	x	x	x	x	x
LO	Describe and asses the 'St. Elmo's fire' weather phenomenon.	x	x	x	x	x	x
LO	Describe the development of lightning discharges.	x	x	x	x	x	x
LO	Describe the effect of lightning strike on aircraft and flight execution.	x	x	x	x	x	x
050 09 04 04	**Development and effects of downbursts**						
LO	Define the term 'downburst'.	x	x	x	x	x	x
LO	Distinguish between macroburst and microburst.	x	x	x	x	x	x

LO	State the weather situations leading to the formation of downbursts.	x	x	x	x	x	x
LO	Describe the process of development of a downburst.	x	x	x	x	x	x
LO	Give the typical duration of a downburst.	x	x	x	x	x	x
LO	Describe the effects of downbursts.	x	x	x	x	x	x
050 09 04 05	**Thunderstorm avoidance**						
LO	Explain how the pilot can anticipate each type of thunderstorms: pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar and by airborne weather radar (Refer to 050 10 01 04), use of the stormscope (lightning detector).	x	x	x	x	x	x
LO	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms.	x	x	x	x	x	x
050 09 05 00	**Tornadoes**						
050 09 05 01	**Properties and occurrence**						
LO	Define the 'tornado'.	x	x	x	x	x	x
LO	Describe the formation of a tornado.	x		x	x		
LO	Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement and wind speed (including Fujita scale).	x		x	x		
LO	Compare the occurrence of tornadoes in Europe with the occurrence in other locations, especially in the United States of America.	x		x	x		
LO	Compare the dimensions and properties of tornadoes and dust devils.	x		x	x		
050 09 06 00	**Inversions**						
050 09 06 01	**Influence on aircraft performance**						
LO	Explain the influence of inversions on the aircraft performance.	x	x	x	x	x	x
LO	Compare the flight hazards during take-off and approach associated to a strong inversion alone and to a strong inversion combined with marked wind shear.	x	x	x	x	x	x
050 09 07 00	**Stratospheric conditions**						
050 09 07 01	**Influence on aircraft performance**						

LO	Summarise the advantages of stratospheric flights.	x		x	x		
LO	List the influences of the phenomena associated with the lower stratosphere (wind, temperature, air density, turbulence).	x		x	x		
050 09 08 00	**Hazards in mountainous areas**						
050 09 08 01	**Influence of terrain on clouds and precipitation, frontal passage**						
LO	Describe the influence of a mountainous terrain on cloud and precipitation.	x	x	x	x	x	x
LO	Describe the effects of the Foehn.	x	x	x	x	x	x
LO	Describe the influence of a mountainous area on a frontal passage.	x	x	x	x	x	x
050 09 08 02	**Vertical movements, mountain waves, wind shear, turbulence,** **ice accretion**						
LO	Describe the vertical movements, wind shear and turbulence typical of mountain areas.	x	x	x	x	x	x
LO	Indicate in a sketch of a chain of mountains the turbulent zones (mountain waves, rotors).	x	x	x	x	x	x
LO	Explain the influence of relief on ice accretion.	x	x	x	x	x	x
050 09 08 03	**Development and effect of valley inversions**						
LO	Describe the formation of valley inversion due to katabatic winds.	x	x	x	x	x	x
LO	Describe the valley inversion formed by warm winds aloft.	x	x	x	x	x	x
LO	Describe the effects of a valley inversion for an aircraft in flight.	x	x	x	x	x	x
050 09 09 00	**Visibility-reducing phenomena**						
050 09 09 01	**Reduction of visibility caused by precipitation and obscurations**						
LO	Describe the reduction of visibility caused by precipitation: drizzle, rain, snow.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by obscurations: fog, mist, haze, smoke, volcanic ash.	x	x	x	x	x	x

LO	Describe the reduction of visibility caused by obscurations: sand (SA), dust (DU).	x		x	x		
LO	Describe the differences between ground visibility, flight visibility, slant visibility and vertical visibility when an aircraft is above or within a layer of haze or fog.	x	x	x	x	x	x
050 09 09 02	**Reduction of visibility caused by other phenomena**						
LO	Describe the reduction of visibility caused by: low drifting and blowing snow.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: low drifting and blowing dust and sand.	x		x	x		
LO	Describe the reduction of visibility caused by: dust storm (DS) and sandstorm (SS).	x		x	x		
LO	Describe the reduction of visibility caused by: icing (windshield).	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: the position of the sun relative to the visual direction.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: the reflection of sun's rays from the top of the layers of haze, fog and clouds.	x	x	x	x	x	x
050 10 00 00	**METEOROLOGICAL INFORMATION**						
050 10 01 00	**Observation**						
050 10 01 01	**Surface observations**						
LO	Define 'surface wind'.	x	x	x	x	x	x
LO	Describe the meteorological measurement of surface wind.	x	x	x	x	x	x
LO	List the ICAO units for the wind direction and speed used in METARs (kt, m/s, km/h). (Refer to 050 02 01 01)	x	x	x	x	x	x
LO	Define 'gusts', as given in METARs.	x	x	x	x	x	x
LO	Distinguish wind given in METARs and wind given by the control tower for take-off and landing.	x	x	x	x	x	x
LO	Define 'visibility'.	x	x	x	x	x	x

LO	Describe the meteorological measurement of visibility.	x	x	x	x	x	x
LO	Define 'prevailing visibility'.	x	x	x	x	x	x
LO	Define 'ground visibility'.	x	x	x	x	x	x
LO	List the units used for visibility (m, km).	x	x	x	x	x	x
LO	Define 'runway visual range'.	x	x	x	x	x	x
LO	Describe the meteorological measurement of runway visual range.	x	x	x	x	x	x
LO	Indicate where the transmissometers/ forward-scatter meters are placed on the airport.	x	x	x	x	x	x
LO	List the units used for runway visual range (m).	x	x	x	x	x	x
LO	List the different possibilities to transmit information to pilots about runway visual range.	x	x	x	x	x	x
LO	Compare visibility and runway visual range.	x	x	x	x	x	x
LO	Indicate the means of observation of present weather.	x	x	x	x	x	x
LO	Indicate the means of observing clouds: type, amount, height of base (ceilometers) and top.	x	x	x	x	x	x
LO	List the clouds considered in meteorological reports, and how they are indicated in METARs (TCU, CB).	x	x	x	x	x	x
LO	Define 'oktas'.	x	x	x	x	x	x
LO	Define 'cloud base'.	x	x	x	x	x	x
LO	Define 'ceiling'.	x	x	x	x	x	x
LO	Name the unit and the reference level used for information about cloud base (ft).	x	x	x	x	x	x
LO	Define 'vertical visibility'.	x	x	x	x	x	x
LO	Explain briefly how and when vertical visibility is measured.	x	x	x	x	x	x
LO	Name the unit used for vertical visibility (ft).	x	x	x	x	x	x
LO	Indicate the means of observation of air temperature (thermometer).	x	x	x	x	x	x
LO	List the units used for air temperature (Celsius, Fahrenheit, Kelvin). (Refer to 050 01 02 01)	x	x	x	x	x	x

LO	Indicate the means of observation of relative humidity (hygrometer and psychrometer) and dew-point temperature (calculation).	x	x	x	x	x	x
LO	Name the units of relative humidity (%) and dew-point temperature (Celsius, Fahrenheit).	x	x	x	x	x	x
LO	Indicate the means of observation of atmospheric pressure (mercury and aneroid barometer).	x	x	x	x	x	x
LO	List the units of atmospheric pressure (hPa, inches). (Refer to 050 01 03 01)	x	x	x	x	x	x
050 10 01 02	**Radiosonde observations**						
LO	Describe the principle of radiosondes.	x	x	x	x	x	x
LO	Describe and interpret the sounding by radiosonde given on a simplified T-P diagram.	x	x	x	x	x	x
050 10 01 03	**Satellite observations**						
LO	Describe the basic outlines of satellite observations.	x	x	x	x	x	x
LO	Name the main uses of satellite pictures in aviation meteorology.	x	x	x	x	x	x
LO	Describe the different types of satellite imagery.	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights: location of clouds (distinguish between stratiform and cumuliform clouds).	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights: location of fronts.	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights: location of jet streams.	x		x	x		
050 10 01 04	**Weather-radar observations** **(Refer to 050 09 04 05)**						
LO	Describe the basic principle and the type of information given by a ground weather radar.	x	x	x	x	x	x
LO	Interpret ground weather radar images.	x	x	x	x	x	x
LO	Describe the basic principle and the type of information given by airborne weather radar.	x	x	x	x	x	x
LO	Describe the limits and the errors of airborne weather radar information.	x	x	x	x	x	x

LO	Interpret typical airborne weather radar images.	x	x	x	x	x	x
050 10 01 05	**Aircraft observations and reporting**						
LO	Describe routine air report and special air report.	x	x	x	x	x	x
LO	State the obligation of a pilot to prepare air reports.	x	x	x	x	x	x
LO	Name the weather phenomena to be stated in a special air report.	x	x	x	x	x	x
050 10 02 00	**Weather charts**						
050 10 02 01	**Significant weather charts**						
LO	Decode and interpret significant weather charts (low, medium and high level).	x	x	x	x	x	x
LO	Describe from a significant weather chart the flight conditions at designated locations and/or along a defined flight route at a given flight level.	x	x	x	x	x	x
050 10 02 02	**Surface charts**						
LO	Recognise the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high and low-pressure areas.	x	x	x	x	x	x
LO	Determine from surface weather charts the wind direction and speed.	x	x	x	x	x	x
050 10 02 03	**Upper-air charts**						
LO	Define 'constant-pressure chart'.	x	x	x	x	x	x
LO	Define 'isohypse (contour line)'. (Refer to 050 01 03 02)	x	x	x	x	x	x
LO	Define 'isotherm'.	x	x	x	x	x	x
LO	Define 'isotach'.	x	x	x	x	x	x
LO	Describe forecast upper-wind and temperature charts.	x	x	x	x	x	x
LO	For designated locations and/or routes determine from forecast upper-wind and temperature charts, if necessary by interpolation, the spot/average values for outside-air temperature, temperature deviation from ISA, wind direction and wind speed.	x	x	x	x	x	x
LO	Name the most common flight levels corresponding to the constant pressure charts.	x	x	x	x	x	x
050 10 03 00	**Information for flight planning**						

050 10 03 01	**Aviation weather messages**						
LO	Describe, decode and interpret the following aviation weather messages (given in written and/or graphical format): METAR, SPECI, TREND, TAF, SIGMET, AIRMET, GAMET, special air report, volcanic ash advisory information.	x	x	x	x	x	x
LO	Describe, decode and interpret the tropical cyclone advisory information in written and graphical form.	x		x	x		
LO	Describe the general meaning of MET REPORT and SPECIAL REPORT.	x	x	x	x	x	x
LO	List, in general, the cases when a SIGMET and an AIRMET are issued.	x	x	x	x	x	x
LO	Describe, decode (by using a code table) and interpret the following messages: Runway State Message (as written in a METAR), GAFOR. Remark: For Runway State Message and GAFOR, refer to the Air Navigation Plan European Region Doc 7754.	x	x	x	x	x	x
050 10 03 02	**Meteorological broadcasts for aviation**						
LO	Describe the meteorological content of broadcasts for aviation: VOLMET, ATIS;	x	x	x	x	x	x
	HF-VOLMET.	x		x	x		
050 10 03 03	**Use of meteorological documents**						
LO	Describe meteorological briefing and advice.	x	x	x	x	x	x
LO	List the information that a flight crew can receive from meteorological services for pre-flight planning and apply the content of this information on a designated flight route.	x	x	x	x	x	x
LO	List the meteorological information that a flight crew can receive from flight information services during flight and apply the content of this information for the continuation of the flight.	x	x	x	x	x	x
050 10 03 04	**Meteorological warnings**						
LO	Describe and interpret aerodrome warnings and wind-shear warnings and alerts.	x	x	x	x	x	x
050 10 04 00	**Meteorological services**						
050 10 04 01	**World area forecast system and meteorological offices**						

LO	Name the main objectives of the world area forecast system: world area forecast centres (upper-air forecasts).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: meteorological offices (aerodrome forecasts, briefing documents).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: meteorological watch offices (SIGMET, AIRMET).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: aeronautical meteorological stations (METAR, MET reports).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: volcanic ash advisory centres.	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: tropical cyclone advisory centres.	x		x	x		
050 10 04 02	**International organisations**						
LO	Describe briefly the following organisations and their chief activities: International Civil Aviation Organization (ICAO) (Refer to subject 010); World Meteorological Organization (WMO).	x	x	x	x	x	x

J. SUBJECT 061 — GENERAL NAVIGATION

For the purposes of theoretical knowledge examinations, orthomorphic and conformal charts are taken as being the same type of chart.

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
060 00 00 00	**NAVIGATION**						
061 00 00 00	**GENERAL NAVIGATION**						

061 01 00 00	**BASICS OF NAVIGATION**						
061 01 01 00	**The solar system**						
061 01 01 01	**Earth's orbit, seasons and apparent movement of the sun**						
LO	State that the solar system consists of the Sun, a number of planets of which the Earth is one, and a large number of asteroids and comets.	x	x	x	x	x	
LO	State that Kepler's first law explains that the planets revolve in elliptical orbits with the Sun at one focus. Each planet has its orbital period.	x	x	x	x	x	
LO	State that Kepler's second law explains the variation in the speed of a planet in its orbit. Each planet revolves so that its radius vector sweeps out equal areas in equal intervals of time.	x	x	x	x	x	
LO	State that the highest speed of the Earth in its orbit is when the Earth is closest to the Sun (perihelion).	x	x	x	x	x	
LO	State that the lowest speed of the Earth in its orbit is when the Earth is furthest away from the Sun (aphelion).	x	x	x	x	x	
LO	Explain in which direction the Earth rotates on its axis.	x	x	x	x	x	
LO	Explain that the axis of rotation of the Earth is inclined to its orbital path around the Sun at an angle of about 66,5 degrees.	x	x	x	x	x	
LO	Define the term 'ecliptic' and 'plane of the ecliptic'. Ecliptic is the apparent path of the Sun around the Earth. The plane of the ecliptic is inclined to the plane of the equator at an angle of approximately 23,5 degrees. The inclination of the polar axis to the plane of the ecliptic is the reason for the seasons.	x	x	x	x	x	
LO	Explain that the Earth completes one orbit around the Sun in approximately 365,25 days.	x	x	x	x	x	
LO	Describe the effect of the inclination of the Earth's rotation axis to the plane of its orbit around the Sun, being the seasons and variation of sunrise and sunset with latitude and time of the year.	x	x	x	x	x	
LO	Define the terms 'apparent Sun' and 'mean Sun' and state their relationship.	x	x	x	x	x	
LO	Define the 'celestial equator'. It is the projection of the Earth's equator onto the celestial sphere.	x	x	x	x	x	

LO	Define the term 'declination'. Declination is the angular distance of a celestial body north or south of the celestial equator.	x	x	x	x	x	
LO	State that the mean Sun is conceived to move eastward along the celestial equator at a rate that provides a uniform measure of time equal to the average time reckoned from the true Sun.	x	x	x	x	x	
LO	Define the 'polar circles', the 'tropic of Cancer' and the 'tropic of Capricorn'.	x	x	x	x	x	
LO	Explain summer and winter solstice.	x	x	x	x	x	
LO	Explain the terms 'spring and autumn equinox'.	x	x	x	x	x	
LO	Explain at which time of the year the duration of daylight changes at the highest rate.	x	x	x	x	x	
LO	Explain the relationship between the declination of the Sun, latitude and the period of daylight.	x	x	x	x	x	
LO	State that the perihelion occurs early January and aphelion occurs early July.	x	x	x	x	x	
LO	Illustrate the position of the Earth relative to the Sun with respect to the seasons and months of the year.	x	x	x	x	x	
LO	Define 'zenith'. The point on the sky vertically overhead an observer.	x	x	x	x	x	
061 01 02 00	**The Earth**						
061 01 02 01	**Great circle, small circle, rhumb line**						
LO	State that the Earth is not a true sphere. It is flattened slightly at the poles. The value for flattening is 1/298.	x	x	x	x	x	
LO	Given the Earth flattening and either the semimajor or semiminor axis in NM/km, calculate the distance of the other axis.	x	x	x	x	x	
LO	State that the Earth may be described as an 'ellipsoid' or 'oblate spheroid'.	x	x	x	x	x	
LO	Explain that the Equator has its plane perpendicular to the Earth's axis and divides the Earth into the northern and southern hemisphere.	x	x	x	x	x	
LO	Given that the distance of the circumference of the Earth is 40 000 km or approximately 21 600 NM, calculate the approximate Earth diameter or Earth radius.	x	x	x	x	x	
LO	Define a 'great circle' in relation to the surface of a sphere.	x	x	x	x	x	

LO	Describe the 'geometric properties' of a great circle, including vertex.	x	x	x	x	x	
LO	Define a 'small circle' in relation to the surface of a sphere.	x	x	x	x	x	
LO	Define a 'rhumb line'. A line which cuts all meridians at the same angle.	x	x	x	x	x	
061 01 02 02	**Convergency, conversion angle**						
LO	Explain the term 'convergency of meridians' between two positions.	x	x	x	x	x	
LO	Explain how the value of convergency can be determined using calculation.	x	x	x	x	x	
LO	The formula to calculate convergency between two positions relatively close to each other is: convergency = difference of longitude × sin (mean latitude).	x	x	x	x	x	
LO	Calculate the value of convergency between two stated positions.	x	x	x	x	x	
LO	Explain that the difference between great-circle track and rhumb-line track at a specified position is called conversion angle.	x	x	x	x	x	
LO	State that over short distances and out-of-polar regions the average great-circle true track is approximately equal to the rhumb-line true track between two positions.	x	x	x	x	x	
LO	Explain how the value of conversion angle can be calculated as half the value of convergency.	x	x	x	x	x	
LO	Calculate the great-circle track and rhumb-line track angle at specified position involving calculations of convergency and conversion angle.	x	x	x	x	x	
061 01 02 03	**Latitude, difference of latitude**						
LO	Define 'geographic latitude' as the angle between the plane of the equator and the local plumb line on the ellipsoid.	x	x	x	x	x	
LO	Define 'geocentric latitude' as the angle between the plane of the equator and a line from the position to the centre of the Earth.	x	x	x	x	x	
LO	State that the maximum difference between geographic and geocentric latitude occurs at altitude of 45 degrees.	x	x	x	x	x	

LO	Describe a parallel of latitude as a small circle connecting all positions on the Earth with the same latitude.	x	x	x	x	x	
LO	Calculate the difference of latitude between two given positions lat/long.	x	x	x	x	x	
LO	State that the 1-degree difference of latitude equals 60 nautical miles.	x	x	x	x	x	
LO	Convert the difference of latitude to distance.	x	x	x	x	x	
LO	Calculate the mean latitude between two positions.	x	x	x	x	x	
061 01 02 04	**Longitude, difference of longitude**						
LO	Describe a meridian as a semigreat circle, which runs north and south from pole to pole.	x	x	x	x	x	
LO	Explain that the meridians and their anti-meridian complete a great circle.	x	x	x	x	x	
LO	State that the Greenwich meridian is also known as the prime meridian.	x	x	x	x	x	
LO	Define 'longitude' as the angle measured at the polar axis between the plane of the prime meridian and the local meridian.	x	x	x	x	x	
LO	Explain that the Greenwich anti-meridian is the maximum longitude possible, namely 180° east–west.	x	x	x	x	x	
LO	Calculate the difference of longitude between two given positions lat/long.	x	x	x	x	x	
LO	Name examples of great circles on the surface of the Earth.	x	x	x	x	x	
LO	Name examples of small circles on the surface of the Earth.	x	x	x	x	x	
LO	Define a 'rhumb line'. A line intersecting all meridians at the same angle.	x	x	x	x	x	
LO	Explain the geometrical properties of a rhumb line. Parallels and meridians are special cases of rhumb lines.	x	x	x	x	x	
061 01 02 05	**Use of latitude and longitude coordinates to locate any specific position**						
LO	Explain that along the equator a difference of longitude of 1° equals a distance of 60 NM.	x	x	x	x	x	
LO	Explain that because the meridians converge towards the poles, the distance between meridians will decrease with increase in latitude.	x	x	x	x	x	

LO	State that the Earth's distance along a parallel of latitude is also known as departure.	x	x	x	x	x	
LO	Calculate the Earth's distance between two meridians along a parallel of latitude (departure) using the following formula: distance = difference of longitude × 60 × cosine latitude.	x	x	x	x	x	
LO	Given a position lat/long, distances travelled north–south in NM/km and distances travelled east–west in NM/km along a parallel of latitude. Calculate the new position.	x	x	x	x	x	
LO	Given two positions on same meridian (or one on the anti-meridian), calculate the distance.	x	x	x	x	x	
061 01 03 00	**Time and time conversions**						
061 01 03 01	**Apparent time**						
LO	Explain the principles of zone time.	x	x	x	x	x	
LO	Explain that, because the Earth rotates on its axis from west to east, the celestial bodies appear to revolve around the Earth from east to west.	x	x	x	x	x	
LO	Define and explain the term 'transit'. Explain that transit means that a celestial body crosses the observer's meridian.	x	x	x	x	x	
LO	Explain that the time period of a 'day' is the elapsed time between two successive transits of a heavenly body.	x	x	x	x	x	
LO	Explain that the term 'sidereal day' is the time measured with reference to a fixed point on the celestial sphere.	x	x	x	x	x	
LO	State that if the day is measured by the apparent passage of the Sun, the length of a day will vary.	x	x	x	x	x	
LO	Explain the reason for the variation in the length of an apparent day, being a combination of the variation in the Earth's orbital speed around the Sun and the inclination of the Earth's rotation axis to the plane of the ecliptic.	x	x	x	x	x	
LO	Illustrate that, since both the direction of rotation of the Earth around its axis and its orbital rotation around the Sun are the same, the Earth must rotate through more than 360° to produce successive transits.	x	x	x	x	x	

LO	State that the period between two successive transits of the Sun is called an apparent solar day, and that the time based on this is called apparent time.	x	x	x	x	x	
LO	State that in order to have a constant measurement of time, which will still have the solar day as a basis, the average length of an apparent solar day is taken. This average day is called mean solar day. It is divided into 24 hours of mean time.	x	x	x	x	x	
LO	State that the mean Sun is a fictitious Sun orbiting along the plane of the equator at a constant angular velocity that provides a uniform measure of time.	x	x	x	x	x	
LO	State that the time between two successive transits of the mean Sun over a meridian is constant.	x	x	x	x	x	
LO	Explain that the difference between apparent time and mean time is defined as the 'equation of time'.	x	x	x	x	x	
LO	State that the time of orbital revolution of the Earth in 1 year around the Sun is approximately 365 ¼ calendar days.	x	x	x	x	x	
LO	State that the calendar year is 365 days and every 4th year a leap year with 366 days and 3 leap years are suppressed every 4 centuries.	x	x	x	x	x	
LO	State that time can also be measured in arc since, in one day of mean solar time, the mean Sun is imagined to travel in a complete circle round the Earth, a motion of 360° in 24 hours.	x	x	x	x	x	
LO	Illustrate the relationship between time and arc along the equator.	x	x	x	x	x	
LO	Deduce conversion values for arc to time and visa versa.	x	x	x	x	x	
061 01 03 02	**Universal Time Coordinated (UTC)**						
LO	State that the Greenwich meridian is selected as standard meridian, and that LMT at the Greenwich meridian is equal to Greenwich mean time (GMT).	x	x	x	x	x	
LO	State that UTC is based on atomic time and GMT on the Earth's rotation, but in practice they are considered as the same.	x	x	x	x	x	
LO	State that the conversion factor between LMT and UTC is arc (change of longitude) converted to time.	x	x	x	x	x	
LO	Convert arc to time.	x	x	x	x	x	
LO	Convert time to arc.	x	x	x	x	x	

LO	Convert between UTC and LMT.	x	x	x	x	x	
061 01 03 03	**Local Mean Time (LMT)**						
LO	State that the beginning of the local mean day at any location is when the mean Sun is in transit with the anti-meridian. This is known as midnight or 0000 hours LMT.	x	x	x	x	x	
LO	State that when the mean Sun is in transit with the location’s meridian, it is noon or 1200 hours LMT.	x	x	x	x	x	
LO	State that the LMT at locations at different longitudes varies by an amount corresponding to the change in longitude.						
061 01 03 04	**Standard times (STs)**						
LO	State that standard time is the time used by a particular country (or part of a country) determined by the government of that particular country.	x	x	x	x	x	
LO	State that some countries use summer time (daylight saving time).	x	x	x	x	x	
LO	State that conversion from UTC to standard time and visa versa is usually done using extracts from the air almanac published in appropriate documents.	x	x	x	x	x	
LO	Given appropriate documents, convert from UTC to ST of a specific country and from ST of a specific country to UTC.	x	x	x	x	x	
061 01 03 05	**Dateline**						
LO	Explain the effect on the LMT when approaching the 180° meridian line from either side.	x	x	x	x	x	
LO	State that the dateline does not follow exactly the 180° east–west meridian.	x	x	x	x	x	
LO	Explain that when crossing the anti-meridian of Greenwich, one day is lost or gained depending on the direction of travel.	x	x	x	x	x	
LO	State that the dateline is the actual place where the change is made and, although mainly at the 180° meridian, there are some slight divergences in order to avoid countries being divided by the dateline.	x	x	x	x	x	
LO	State that when calculating times, the dateline is automatically taken into account by doing all conversions via UTC.	x	x	x	x	x	
LO	Calculate conversions of LMT and GMT/UTC and ST for cases involving the international dateline.	x	x	x	x	x	

061 01 03 06	**Determination of sunrise (SR), sunset (SS) and civil twilight**						
LO	State that SR or SS is when the Sun's upper edge is at the observer's horizon. State how atmospheric refraction affects this apparent sighting.	x	x	x	x	x	
LO	Explain that SR and SS occur at different times on the same meridian depending on the latitude for a given day.	x	x	x	x	x	
LO	Explain that SR will occur earlier and SS will occur later with increase in altitude.	x	x	x	x	x	
LO	State that the times for SR and SS given in the air almanac are calculated for the Greenwich meridian.	x	x	x	x	x	
LO	Explain that at the spring and autumn equinox, SR and SS occur approximately at the same time at all latitudes.	x	x	x	x	x	
LO	State that, except in high latitudes, the times of SR and SS at any place change only a little each day. So, for all places of the same latitude, SR or SS will occur at approximately the same LMT.	x	x	x	x	x	
LO	State that the reason for the variation of the duration of daylight and night throughout the year is the inclination of the Earth's rotation axis to the ecliptic.	x	x	x	x	x	
LO	State that SR and SS times are tabulated against specified dates and latitudes.	x	x	x	x	x	
LO	State that at equator SR is always close to 0600 LMT and SS close to 1800 LMT (within 15 minutes).	x	x	x	x	x	
LO	Calculate examples of SR and SS at mean sea level in LMT, ST or UTC, given SR and SS tables, latitudes and longitude of the place in question and the date.	x	x	x	x	x	
LO	Given SR or SS time in UTC or ST for a given position, calculate SR or SS for another position on the same latitude in UTC or ST.	x	x	x	x	x	
LO	Explain the meaning of the term 'twilight'.	x	x	x	x	x	
LO	Define the 'duration of evening civil twilight'. The time from sunset to the time when the centre of the Sun is 6° below the horizon.	x	x	x	x	x	
LO	Define the 'duration of morning civil twilight'. The time from the point when the centre of the Sun is 6° below the horizon to the time of sunrise.	x	x	x	x	x	

LO	State that the beginning of morning civil twilight and the end of evening civil twilight has been tabulated in UTC, valid for the prime meridian, with latitude and date as the entering argument. It may be taken to be LMT for any other meridian.	x	x	x	x	x	
LO	Calculate examples of twilight in UTC and ST given a twilight table, latitude and longitude of the place in question and the date.	x	x	x	x	x	
LO	Determine the duration of morning and evening civil twilight.	x	x	x	x	x	
LO	Explain the effect of declination and latitude on the duration of twilight.	x	x	x	x	x	
061 01 04 00	**Directions**						
061 01 04 01	**True north**						
LO	State that all meridians run in north–south direction, and that the true-north direction is along any meridian towards the geographic north pole.	x	x	x	x	x	
LO	State that true directions are measured clockwise as an angle in degrees from true north (TN).	x	x	x	x	x	
061 01 04 02	**Terrestrial magnetism: magnetic north, inclination and variation**						
LO	State that a freely suspended compass needle will turn to the direction of the local magnetic field. The direction of the horizontal component of this field is the direction of magnetic north (MN).	x	x	x	x	x	
LO	State that the magnetic poles do not coincide with the geographic poles.	x	x	x	x	x	
LO	State that the magnetic variation varies as a function of time due to the movement of the northern magnetic pole.	x	x	x	x	x	
LO	Define 'magnetic dip or inclination'. The angle between the horizontal and the total component of the magnetic field.	x	x	x	x	x	
LO	State that the angle of inclination at the magnetic poles is 90°.	x	x	x	x	x	
LO	Explain that the accuracy of the compass depends on the strength of the horizontal component of the Earth's magnetic field.	x	x	x	x	x	
LO	State that, in the polar areas, the horizontal component of the Earth's magnetic field is too weak to permit the use of a magnetic compass.	x	x	x	x	x	

061 01 04 03	**Compass deviation, compass north**						
LO	State that, in a direct-reading compass, the magnetic element will align along a magnetic field. This direction is called compass north (CN) and is the direction 000° on the compass rose. The field is the resultant of the Earth's magnetic field and the magnetic field of the aircraft.	x	x	x	x	x	
LO	State that the effect of the aircraft magnetism on the compass changes with different headings, as well as with different latitudes.	x	x	x	x	x	
LO	State that the angle between magnetic north and compass north is called deviation (DEV) and is given in degrees east (+ or E) or west (– or W) of the magnetic north.	x	x	x	x	x	
LO	State that deviation is kept to a minimum by compass swinging.	x	x	x	x	x	
061 01 04 04	**Isogonals, relationship between true and magnetic north**						
LO	State that the angle between the true north and magnetic north is called variation (VAR) being measured in degrees east (+ or E) or west (– or W) of the true north.	x	x	x	x	x	
LO	Define an 'isogonal line'. A line joining positions of equal variation.	x	x	x	x	x	
LO	Convert between compass, magnetic and true directions.	x	x	x	x	x	
061 01 04 05	**Gridlines, isogrives**						
LO	Explain the purpose of a grid north (GN) based on a suitable meridian on a polar stereographic chart (reference or datum meridian).	x		x	x		
LO	Explain that the gridlines or the grid meridians are drawn on the chart parallel to the reference meridian.	x		x	x		
LO	State that the angle between the grid north (GN) and true north (TN) is called grid convergence being measured in degrees east (+ or E) if GN is west of TN or west (– or W) if GN is east of TN.	x		x	x		
LO	State that the angle between the grid north (GN) and magnetic north (MN) is called grivation (griv) being measured in degrees east (+ or E) or west (– or W) of the grid north.	x		x	x		

LO	State that a line joining points, which have the same grivation, is called an isogriv.	x		x	x		
LO	Convert between compass, magnetic, true and grid directions.	x		x	x		
061 01 05 00	**Distance**						
061 01 05 01	**Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres, feet**						
LO	Define the ‘nautical mile’. A distance being equal to 1 852 km.	x	x	x	x	x	
LO	In map/charts, distance between two positions is measured along a meridian at mean latitude, where 1 minute of latitude presents 1 NM.	x	x	x	x	x	
LO	State that when dealing with heights and altitudes the unit used is metres or feet subject to the choice of individual States.	x	x	x	x	x	
061 01 05 02	**Conversion from one unit to another**						
LO	Convert between the following units: nautical miles (NM), statute miles (SM), kilometres (km), metres (m) and feet (ft).	x	x	x	x	x	
061 01 05 03	**Relationship between nautical miles and minutes of latitude and minutes of longitude**						
LO	State that horizontal distances are calculated in metres, kilometres and nautical miles.	x	x	x	x	x	
LO	Given two positions or latitude/longitude difference, calculate the distance.	x	x	x	x	x	
LO	Given two positions on the same latitude and distance between the two positions in km or NM, calculate the difference of longitude between the two positions.	x	x	x	x	x	
LO	Flying a rhumb-line true track of 090, 180, 270 and 360 degrees given an initial geographical position, flight time and ground speed, calculate the new geographic position.	x	x	x	x	x	
061 02 00 00	**MAGNETISM AND COMPASSES**						
061 02 01 00	**Knowledge of the principles of the direct-reading (standby) compass**						
061 02 01 01	**The use of this compass**						
LO	Direct-reading compass (DRC).	x	x	x	x	x	

LO	Interpret the indications on a DRC, given an indication on the compass, deviation or deviation table and variation.	x	x	x	x	x	
061 02 01 02	**Serviceability tests**						
LO	State the pre-flight serviceability check of the DRC, such as: general condition; check indication is within the limits.	x	x	x	x	x	
LO	State that the serviceability test consists of comparing the DRC indication to another reference (e.g. other compass system or runway direction).	x	x	x	x	x	
LO	State that the compass should be checked when carrying magnetic freight or freight with a large ferrous metal content.	x	x	x	x	x	
061 02 01 03	**Situations requiring a compass swing**						
LO	State the occurrences when a compass swing may be required: if transferred to another base involving a large change in latitude; major changes in aircraft equipment; aircraft hit by lightning; aircraft parked in the same direction for a long period of time; when a new compass is fitted; at any time when the compass or recorded deviation is suspect; when specified in the aircraft maintenance schedule.	x	x	x	x	x	
061 03 00 00	**CHARTS**						
061 03 01 00	**General properties of miscellaneous types of projections**						
LO	Define the term ‘conformal’. At any given point on the chart, distortions (as a result of the projection) in east–west direction must be the same as in north–south direction. The meridians and parallels must cut each other at right angles.	x	x	x	x	x	
LO	State that on a conformal chart the angles measured on the chart are the same as on the Earth.	x	x	x	x	x	

LO	State that different chart projections are used, depending on the application and area of use involved.	x	x	x	x	x	
LO	State that all charts, although they have been developed mathematically, are designated as projections.	x	x	x	x	x	
LO	State that the following projection surfaces are used when projecting charts: plane, cylindrical, conical.	x	x	x	x	x	
LO	Define the 'scale' of a chart. The ratio of the chart length compared to the Earth's distance that it represents.	x	x	x	x	x	
LO	Use the scale of a chart to calculate particular distances.	x	x	x	x	x	
LO	Calculate scale given chart length and Earth distance.	x	x	x	x	x	
LO	Define the term 'chart convergency'. The angle between two given meridians on the chart.	x	x	x	x	x	
LO	Define 'parallel of origin'. The parallel where the projection surface touches the surface of the reduced Earth.	x	x	x	x	x	
061 03 01 01	**Direct Mercator**						
LO	State that the direct Mercator is a cylindrical projection. The parallel of origin is the equator.	x	x	x	x	x	
LO	State that the convergency on the chart is 0°.	x	x	x	x	x	
LO	State that the scale increases with increasing distance from the equator.	x	x	x	x	x	
LO	State that on a direct Mercator: scale at any latitude = scale at the equator × secant latitude (1/cosine latitude).	x	x	x	x	x	
LO	Given the scale at one latitude, calculate the scale at different latitudes.	x	x	x	x	x	
LO	Given a chart length at one atitude, show that it represents a different Earth distance at other latitudes.	x	x	x	x	x	
061 03 01 02	**Lambert conformal conic**						

LO	State that the Lambert conformal chart is based on a conical projection. Only Lambert conformal charts mathematically produced with two standard parallels will be considered.	x	x	x	x	x	
LO	Define the term ‘standard parallel’. The latitudes where the cone cuts the reduced Earth.	x	x	x	x	x	
LO	State that at the parallel of origin, Earth convergency is equal to chart convergency.	x	x	x	x	x	
LO	State that the parallel of origin is close to the mean latitude between the standard parallels.	x	x	x	x	x	
LO	Explain the scale variation throughout the charts as follows: the scale indicated on the chart will be correct at the standard parallels; the scale will increase away from the parallel of origin; the scale within the standard parallels differs by less than 1 % from the scale stated on the chart.	x	x	x	x	x	
LO	Define the term ‘constant of cone/convergency factor’. The ratio between the top angle of the unfolded cone and 360°, or sine of the parallel of origin.	x	x	x	x	x	
LO	Chart convergency = difference of longitude × constant of cone.	x	x	x	x	x	
LO	Given appropriate data, calculate initial, final or rhumb-line tracks between two positions (lat/long).	x	x	x	x	x	
LO	Given two positions (lat/long) and information to determine convergency between the two positions, calculate the parallel of origin.	x	x	x	x	x	
LO	Given a Lambert chart, determine the parallel of origin, or constant of cone.	x	x	x	x	x	
LO	Given constant of cone or parallel of origin, great-circle track at one position and great-circle track at another position, calculate the difference of longitude between the two positions.	x	x	x	x	x	
061 03 01 03	**Polar stereographic**						
LO	State that the polar stereographic projection is based on a plane projection, and state that the parallel of the origin is the pole.	x		x	x		
LO	State that chart convergency = difference of longitude.	x		x	x		

LO	State that the scale is increasing with increasing distance from the pole.	x		x	x		
LO	Given two positions (lat/long), rhumb-line true track or initial/final great-circle true track, calculate the missing track angles.	x		x	x		
LO	Calculate the chart scale at a specific latitude when difference of longitude and chart distance along the parallel of longitude are given.	x		x	x		
061 03 02 00	**The representation of meridians, parallels, great circles and rhumb lines**						
061 03 02 01	**Direct Mercator**						
LO	State that meridians are straight parallel lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are straight lines parallel to the equator.	x	x	x	x	x	
LO	State that a straight line on the chart is a rhumb line.	x	x	x	x	x	
LO	State that the great circle is a line convex to the nearest pole.	x	x	x	x	x	
LO	For great-circle track angle calculations over short distances, the conversion angle may be calculated by the formula: conversion angle = ½ × difference of longitude × sin mean latitude.	x	x	x	x	x	
LO	Given rhumb-line true track between two positions (lat/long), calculate initial or final great-circle true track.	x	x	x	x	x	
061 03 02 02	**Lambert conformal conic**						
LO	State that meridians are straight lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are arcs of concentric circles.	x	x	x	x	x	
LO	State that great circles are curved lines concave towards the parallels of origin.	x	x	x	x	x	
LO	State that for short distances the great circle is approximately a straight line.	x	x	x	x	x	
061 03 02 03	**Polar stereographic**						
LO	State that meridians are straight lines radiating from the pole, which cut parallels of latitudes at right angles.	x		x	x		

LO	State that parallels of latitude are concentric circles, and in this projection the distance apart increases away from the pole.	x		x	x		
LO	State that great circles are approximately straight lines close to the pole. The exact great circle being concave to the pole.	x		x	x		
061 03 03 00	**The use of current aeronautical charts**						
061 03 03 01	**Plotting positions**						
LO	Enter the position on a chart using range and bearing from a VOR DME station, and derive geographical coordinates.	x	x	x	x	x	
LO	Enter the positions on a chart using geographical coordinates and derive tracks and distances.	x	x	x	x	x	
LO	Plot DME ranges on an aeronautical chart and derive geographical coordinates.	x	x	x	x	x	
LO	Describe the methods used to provide information on chart scale. Use the chart scales stated and beware of the limitations of the stated scale for each projection.	x	x	x	x	x	
061 03 03 02	**Methods of indicating scale and relief**						
LO	Describe the methods of representing relief and demonstrate the ability to interpret data.	x	x	x	x	x	
061 03 03 03	**Conventional signs**						
LO	Interpret conventional signs and symbols on ICAO and other most frequently used charts.	x	x	x	x	x	
061 03 03 04	**Measuring tracks and distances**						
LO	Given two positions, measure the track and the distance between them.	x	x	x	x	x	
061 03 03 05	**Plotting bearings**						
LO	Resolve bearings of an NDB station for plotting on an aeronautical chart.	x	x	x	x	x	
LO	Resolve radials from VOR stations for plotting on an aeronautical chart.	x	x	x	x	x	
061 04 00 00	**DEAD RECKONING (DR) NAVIGATION**						
061 04 01 00	**Basis of dead reckoning**						
LO	Explain the triangle of velocities, e.g. true heading/TAS, W/V, and true track/GS.	x	x	x	x	x	
061 04 01 01	**Track**						

LO	Explain the concept of vectors including adding together or splitting in two directions.	x	x	x	x	x	
061 04 01 02	**Heading (compass, magnetic, true, grid)**						
LO	Calculate (compass, magnetic, true, grid) heading from given appropriate data.	x	x	x	x	x	
061 04 01 03	**Wind velocity**						
LO	Calculate wind velocity from given appropriate data.	x	x	x	x	x	
061 04 01 04	**Airspeed (IAS, CAS, TAS, Mach number)**						
LO	Calculate TAS from IAS/CAS and Mach number from given appropriate data.	x	x	x	x	x	
061 04 01 05	**Ground speed**						
LO	Calculate ground speed from given appropriate data.	x	x	x	x	x	
061 04 01 06	**ETA**						
LO	Calculate ETA, flying time from distance, and GS.	x	x	x	x	x	
LO	Calculate revised directional data for heading, track, course and W/V, e.g. true, magnetic, compass and grid from given appropriate data.	x	x	x	x	x	
061 04 01 07	**Drift, wind correction angle**						
LO	Calculate drift and wind correction angle from given appropriate data.	x	x	x	x	x	
061 04 02 00	**Use of the navigational computer**						
061 04 02 01	**Speed**						
LO	Given appropriate data, determine speed.	x	x	x	x	x	
061 04 02 02	**Time**						
LO	Given appropriate data, determine time.	x	x	x	x	x	
061 04 02 03	**Distance**						
LO	Given appropriate data, determine distance.	x	x	x	x	x	
061 04 02 04	**Fuel consumption**						
LO	Calculation of fuel used/fuel flow/flying time.	x	x	x	x	x	
061 04 02 05	**Conversions**						
LO	Conversion between kilograms/pounds/ litres/U.S. gallons/imperial gallons.	x	x	x	x	x	
LO	Conversion of distances. Kilometres/nautical miles/statute miles.	x	x	x	x	x	

LO	Conversion of distances. Feet/metres.	x	x	x	x	x	
LO	Conversion of volumes and weight of fuel using density in mass per unit volume.	x	x	x	x	x	
061 04 02 06	**Airspeed**						
LO	Calculation of airspeed problems including IAS/EAS/CAS/TAS/ and Mach number from given appropriate data.	x	x	x	x	x	
061 04 02 07	**Wind velocity**						
LO	Given appropriate data, determine wind velocity.	x	x	x	x	x	
061 04 02 08	**True altitude**						
LO	Given appropriate data, determine true altitude/indicated altitude/density altitude.	x	x	x	x	x	
061 04 03 00	**The triangle of velocities**						
LO	Solve problems to determine: heading; ground speed; wind direction and speed; track/course; drift angle/wind correction angle; head/tail/crosswind components.	x	x	x	x	x	
061 04 04 00	**Determination of DR position**						
061 04 04 01	**Confirmation of flight progress (DR)**						
LO	Describe the role and purpose of DR navigation.	x	x	x	x	x	
LO	Demonstrate mental DR techniques.	x	x	x	x	x	
LO	Define 'speed factor'. Speed divided by 60, used for mental flight-path calculations.	x	x	x	x	x	
LO	Calculate head/tailwind component.	x	x	x	x	x	
LO	Calculate wind correction angle (WCA) using the formula: WCA = XWC (crosswind component)/SF (speed factor)	x	x	x	x	x	
LO	Distance, speed and time calculations.	x	x	x	x	x	
LO	Demonstrate DR position graphically and by means of a DR computer.	x	x	x	x	x	

LO	Given any four of the parts of the triangle of velocities, calculate the other two.	x	x	x	x	x	
LO	Apply the validity of wind triangle symbols correctly. Heading vector one arrow, track/course vector two arrows, and W/V vector three arrows.	x	x	x	x	x	
061 04 04 02	**Lost procedures**						
LO	Describe course of action when lost.	x	x	x	x	x	
061 04 05 00	**Measurement of DR elements**						
061 04 05 01	**Calculation of altitude, adjustments, corrections, errors**						
	Remark: For questions involving height calculation, 30 ft/hpa is to be used unless another figure is specified in the question.						
LO	Calculate True Altitude (T ALT) from given indicated altitude, airfield elevation, Static-Air Temperature (SAT)/Outside-Air Temperature (OAT) and QNH/QFE.	x	x	x	x	x	
LO	Calculate indicated altitude from given T ALT, airfield elevation, SAT/OAT and QNH/QFE.	x	x	x	x	x	
LO	Calculate density altitude from given pressure altitude and SAT/OAT.	x	x	x	x	x	
LO	Calculate density altitude from given airfield elevation, SAT/OAT and QNH/QFE.	x	x	x	x	x	
061 04 05 02	**Determination of temperature**						
LO	Define 'OAT/SAT'. The temperature of the surrounding air.	x	x	x	x	x	
LO	Define 'Ram-Air Temperature (RAT)/ Total-Air Temperature (TAT)/ Indicated Outside-Air Temperature (IOAT)'. The temperature measured by the temperature probe affected by friction and compressibility.	x	x	x	x	x	
LO	Define 'ram rise'. The increase of temperature at the temperature probe due to friction and compressibility.	x	x	x	x	x	
LO	RAT (TAT, IOAT) = OAT (SAT) + ram rise.	x	x	x	x	x	
LO	Explain the difference in using OAT/SAT compared to RAT/TAT/IOAT in airspeed calculations.	x	x	x	x	x	
061 04 05 03	**Determination of appropriate speed**						

LO	Explain the relationship between: IAS, CAS, EAS, and TAS.	x	x	x	x	x	
LO	Calculate TAS from given IAS/CAS, OAT/SAT and pressure inputs.	x	x	x	x	x	
LO	Calculate CAS from given TAS, OAT/SAT and pressure inputs.	x	x	x	x	x	
061 04 05 04	**Determination of Mach number**						
LO	Calculate Mach number from given TAS and OAT/SAT.	x	x	x	x	x	
061 05 00 00	**IN-FLIGHT NAVIGATION**						
061 05 01 00	**Use of visual observations and application to in-flight navigation**						
LO	Describe what is meant by the term ‘map reading’.	x	x	x	x	x	
LO	Define the term ‘visual checkpoint’.	x	x	x	x	x	
LO	Discuss the general features of a visual checkpoint and give examples.	x	x	x	x	x	
LO	State that the evaluation of the differences between DR positions and actual position can refine flight performance and navigation.	x	x	x	x	x	
LO	Establish fixes on navigational charts by plotting visually derived intersecting lines of position.	x	x	x	x	x	
LO	Describe the use of a single observed position line to check flight progress.	x	x	x	x	x	
LO	Describe how to prepare and align a map/chart for use in visual navigation.	x	x	x	x	x	

LO	Describe visual-navigation techniques including: use of DR position to locate identifiable landmarks; identification of charted features/ landmarks; factors affecting the selection of landmarks; an understanding of seasonal and meteorological effects on the appearance and visibility of landmarks; selection of suitable landmarks; estimation of distance from landmarks from successive bearings; estimation of the distance from a landmark using an approximation of the sighting angle and the flight altitude.	x	x	x	x	x	
LO	Describe the action to be taken if there is no visual checkpoint available at a scheduled turning point.	x	x	x	x	x	
LO	Understanding the difficulties and limitations that may be encountered in map reading in some geographical areas due to the nature of terrain, lack of distinctive landmarks or lack of detailed and accurate charted data.	x	x	x	x	x	
LO	State the function of contour lines on a topographical chart.	x	x	x	x	x	
LO	Indicate the role of 'layer tinting' (colour gradient) in relation to the depiction of topography on a chart.	x	x	x	x	x	
LO	Using the contours shown on a chart, describe the appearance of a significant feature.	x	x	x	x	x	
LO	Understand that in areas of snow and ice from horizon to horizon and where the sky is covered with a uniform layer of clouds so that no shadows are cast, the horizon disappears, causing earth and sky to blend.	x	x	x	x	x	
061 05 02 00	**Navigation in climb and descent**						
061 05 02 01	**Average airspeed**						
LO	Average TAS used for climb problems is calculated at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	Average TAS used for descent problems is calculated at the altitude 1/2 of the descent altitude.	x	x	x	x	x	
061 05 02 02	**Average wind velocity (WV)**						

LO	WV used for climb problems is the WV at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	WV used for descent problems is the WV at the altitude 1/2 of the descent altitude.	x	x	x	x	x	
LO	Calculate the average climb/descent GS from given TAS at various altitudes, WV at various altitudes and true track.	x	x	x	x	x	
LO	Calculate the flying time and distance during climb/descent from given average rate of climb/descent and using average GS.	x	x	x	x	x	
LO	Calculate the rate of descent on a given glide-path angle using the following formulae: valid for 3°-glide path: rate of descent = (GS (ground speed) × 10) / 2 rate of descent = SF (speed factor) × glide-path angle × 100	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate the rate of climb/descent in order to reach a certain position at a given altitude.	x	x	x	x	x	
LO	Given speed, rate of climb/descent and altitude, calculate the distance required in order to reach a position at a given altitude.	x	x	x	x	x	
LO	Given speed, distance to go and altitude to climb/descent, calculate the rate of climb/descent.	x	x	x	x	x	
LO	State the effect on TAS and Mach number when climbing/descending with a constant CAS.						
061 05 02 03	**Ground speed/distance covered during climb or descent**						
LO	State that most Aircraft Operating Handbooks supply graphical material to calculate climb and descent problems.	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate the rate of climb/ descent in order to reach a certain position at a given altitude.	x	x	x	x	x	
LO	Given speed, rate of climb/descent and altitude, calculate the distance required in order to reach a certain position at a given altitude.	x	x	x	x	x	
061 05 02 04	**Gradients versus rate of climb/descent**						

LO	Calculate climb/descent gradient (ft/NM, % and degrees), GS or vertical speed according to the following formulae: Vertical speed (feet/min) = (ground speed (kt) × gradient (feet/NM)) / 60	x	x	x	x	x	
LO	Gradient in % = altitude difference (feet) × 100 / ground difference (feet).	x	x	x	x	x	
LO	Gradient in degrees = Arctg (Altitude difference (feet) / ground distance (feet)).	x	x	x	x	x	
LO	Rate of climb/descent (feet/min) = gradient (%) × GS (kt).	x	x	x	x	x	
LO	State that it is necessary to determine the position of the aircraft accurately before commencing descent in order to ensure safe ground clearance.	x	x	x	x	x	
061 05 03 00	**Navigation in cruising flight, use of fixes to revise navigation data**						
061 05 03 01	**Ground-speed revision**						
LO	Calculate revised ground speed to reach a waypoint at a specific time.	x	x	x	x	x	
LO	Calculate the average ground speed based on two observed fixes.	x	x	x	x	x	
LO	Calculate the distance to the position passing abeam an NDB station by timing from the position with a relative bearing of 045/315 to the position abeam (relative bearing 090/270).	x	x	x	x	x	
061 05 03 02	**Off-track corrections**						
LO	Calculate the track-error angle at a given course from A to B and an off- course fix, using the one-in-sixty rule.	x	x	x	x	x	
LO	Calculate the heading change at an off-course fix to directly reach the next waypoint using the one-in-sixty rule.	x	x	x	x	x	
LO	Calculate the average drift angle based upon an off-course fix observation.	x	x	x	x	x	
061 05 03 03	**Calculation of wind speed and direction**						
LO	Calculate the average wind speed and direction based on two observed fixes.	x	x	x	x	x	
061 05 03 04	**Estimated Time of Arrival (ETA) revisions**						

LO	Calculate ETA revisions based upon observed fixes and revised ground speed.	x	x	x	x	x	
061 05 04 00	**Flight log**						
LO	Given relevant flight-plan data, calculate the missing data.	x	x	x	x	x	
LO	Enter the revised navigational en route data, for the legs concerned, into the flight log (e.g. updated wind and ground speed, and correspondingly losses or gains in time and fuel consumption).	x	x	x	x	x	
LO	Enter, in the progress of flight, at checkpoint or turning point, the 'actual time over' and the 'estimated time over' for the next checkpoint into the flight log.	x	x	x	x	x	

K. SUBJECT 062 — RADIO NAVIGATION

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
060 00 00 00	**NAVIGATION**						
062 00 00 00	**RADIO NAVIGATION**						
062 01 00 00	**BASIC RADIO PROPAGATION THEORY**						
062 01 01 00	**Basic principles**						
062 01 01 01	**Electromagnetic waves**						
LO	State that radio waves travel at the speed of light, being approximately 300 000 km/s or 162 000 NM/s.	x	x	x	x	x	x
LO	Define a 'cycle'. A complete series of values of a periodical process.	x	x	x	x	x	x
LO	Define 'Hertz (Hz)'. 1 Hertz is 1 cycle per second.	x	x	x	x	x	x
062 01 01 02	**Frequency, wavelength, amplitude, phase angle**						
LO	Define 'frequency'. The number of cycles occurring in 1 second in a radio wave expressed in Hertz (Hz).	x	x	x	x	x	x
LO	Define 'wavelength'. The physical distance travelled by a radio wave during one cycle of transmission.	x	x	x	x	x	x
LO	Define 'amplitude'. The maximum deflection in an oscillation or wave.	x	x	x	x	x	x

LO	State that the relationship between wavelength and frequency is: wavelength (λ) = speed of light (c) / frequency (f); or λ (meters) = 300 000 / kHz.	x	x	x	x	x	x
LO	Define 'phase'. The fraction of one wavelength expressed in degrees from 000° to 360°.	x	x	x	x	x	x
LO	Define 'phase difference/shift'. The angular difference between the corresponding points of two cycles of equal wavelength, which is measurable in degrees.	x	x	x	x	x	x
062 01 01 03	**Frequency bands, sidebands, single sideband**						
LO	List the bands of the frequency spectrum for electromagnetic waves: Very Low Frequency (VLF): 3–30 kHz; Low Frequency (LF): 30–300 kHz; Medium Frequency (MF): 300–3 000 kHz; High Frequency (HF): 3–30 MHz; Very High Frequency (VHF): 30–300 MHz; Ultra High Frequency (UHF): 300–3 000 MHz; Super High Frequency (SHF): 3–30 GHz; Extremely High Frequency (EHF): 30–300 GHz.	x	x	x	x	x	x
LO	State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands.	x	x	x	x	x	x
LO	State that HF Volmet and HF two-way communication use a single sideband.	x	x	x	x	x	x
LO	State that a radio signal may be classified by three symbols in accordance with the ITU Radio Regulation, Volume 1: e.g. A1A. The first symbol indicates the type of modulation of the main carrier; The second symbol indicates the nature of the signal modulating the main carrier; The third symbol indicates the nature of the information to be transmitted.	x	x	x	x	x	x
062 01 01 04	**Pulse characteristics**						

LO	Define the following terms as associated with a pulse string: pulse length, pulse power, continuous power.	x	x	x	x	x	x
062 01 01 05	**Carrier, modulation**						
LO	Define 'carrier wave'. The radio wave acting as the carrier or transporter.	x	x	x	x	x	x
LO	Define 'keying'. Interrupting the carrier wave to break it into dots and dashes.	x	x	x	x	x	x
LO	Define 'modulation'. The technical term for the process of impressing and transporting information by radio waves.	x	x	x	x	x	x
062 01 01 06	**Kinds of modulation (amplitude, frequency, pulse, phase)**						
LO	Define 'amplitude modulation'. The information that is impressed onto the carrier wave by altering the amplitude of the carrier.	x	x	x	x	x	x
LO	Define 'frequency modulation'. The information that is impressed onto the carrier wave by altering the frequency of the carrier.	x	x	x	x	x	x
LO	Describe 'pulse modulation'. A modulation form used in radar by transmitting short pulses followed by larger interruptions.	x	x	x	x	x	x
LO	Describe 'phase modulation'. A modulation form used in GPS where the phase of the carrier wave is reversed.	x	x	x	x	x	x
062 01 02 00	**Antennas**						
062 01 02 01	**Characteristics**						
LO	Define 'antenna'. A wave-type transducer for the process of converting a line AC into a free electromagnetic wave.	x	x	x	x	x	x
LO	State that the simplest type of antenna is a dipole which is a wire of length equal to one-half of the wavelength.	x	x	x	x	x	x
LO	State that in a wire which is fed with an AC (alternating current), some of the power will radiate into space.	x	x	x	x	x	x
LO	State that in a wire parallel to the wire fed with an AC but remote from it, an AC will be induced.	x	x	x	x	x	x

LO	State that an electromagnetic wave always consists of an oscillating electric (E) and an oscillating magnetic (H) field which propagates at the speed of light.	x	x	x	x	x	x
LO	State that the (E) and (H) fields are perpendicular to each other. The oscillations are perpendicular to the propagation direction and are in-phase.	x	x	x	x	x	x
LO	State that the electric field is parallel to the wire and the magnetic field is perpendicular to it.	x	x	x	x	x	x
062 01 02 02	**Polarisation**						
LO	State that the polarisation of an electromagnetic wave describes the orientation of the plane of oscillation of the electrical component of the wave with regard to its direction of propagation.	x	x	x	x	x	x
LO	State that in linear polarisation the plane of oscillation is fixed in space, whereas in circular (eliptical) polarisation the plane is rotating.	x	x	x	x	x	x
LO	Explain the difference between horizontal and vertical polarisation in the dependence of the alignment of the dipole.	x	x	x	x	x	x
062 01 02 03	**Types of antennas**						
LO	List and describe the common different kinds of directional antennas: loop antenna used in old ADF receivers; parabolic antenna used in weather radars; slotted planar array used in more modern weather radars; helical antenna used in GPS transmitters.	x	x	x	x	x	x
062 01 03 00	**Wave propagation**						
062 01 03 01	**Structure of the ionosphere**						
LO	State that the ionosphere is the ionised component of the Earth's upper atmosphere from 60 to 400 km above the surface, which is vertically structured in three regions or layers.	x	x	x	x	x	x
LO	State that the layers in the ionosphere are named D, E and F layers, and their depth varies with time.	x	x	x	x	x	x
LO	State that electromagnetic waves refracted from the E and F layers of the ionosphere are called sky waves.	x	x	x	x	x	x
062 01 03 02	**Ground waves**						

LO	Define 'ground or surface waves'. The electromagnetic waves travelling along the surface of the Earth.	x	x	x	x	x	x
062 01 03 03	**Space waves**						
LO	Define 'space waves'. The electromagnetic waves travelling through the air directly from the transmitter to the receiver.	x	x	x	x	x	x
062 01 03 04	**Propagation with the frequency bands**						
LO	State that radio waves in VHF, UHF, SHF and EHF propagate as space waves.	x	x	x	x	x	x
LO	State that radio waves in VLF, LF, MF and HF propagate as surface/ground waves and sky waves.	x	x	x	x	x	x
062 01 03 05	**Doppler principle**						
LO	State that Doppler effect is the phenomenon that the frequency of an electromagnetic wave will increase or decrease if there is relative motion between the transmitter and the receiver.	x	x	x	x	x	x
LO	State that the frequency will increase if the transmitter and receiver are converging, and will decrease if they are diverging.	x	x	x	x	x	x
062 01 03 06	**Factors affecting propagation**						
LO	Define 'skip distance'. The distance between the transmitter and the point on the surface of the Earth where the first sky return arrives.	x	x	x	x	x	x
LO	State that skip zone/dead space is the distance between the limit of the surface wave and the sky wave.	x	x	x	x	x	x
LO	Describe 'fading'. When a receiver picks up the sky signal and the surface signal, the signals will interfere with each other causing the signals to be cancelled out.	x	x	x	x	x	x
LO	State that radio waves in the VHF band and above are limited in range as they are not reflected by the ionosphere and do not have a surface wave.	x	x	x	x	x	x
LO	Describe the physical phenomena reflection, refraction, diffraction, absorption and interference.	x	x	x	x	x	x
062 02 00 00	**RADIO AIDS**						
062 02 01 00	**Ground D/F**						
062 02 01 01	**Principles**						
LO	Describe the use of a Ground Direction Finder.	x	x	x	x	x	x

LO	Explain why the service provided is subdivided as: — VHF direction finding (VDF) — UHF direction finding (UDF).	x	x	x	x	x	x
LO	Explain the limitation of range because of the path of the VHF signal.	x	x	x	x	x	x
LO	Describe the operation of the VDF in the following general terms: radio waves emitted by the radio-telephony (R/T) equipment of the aircraft; special directional antenna; determination of the direction of the incoming signal; ATC display.	x	x	x	x	x	x
062 02 01 02	**Presentation and interpretation**						
LO	Define the term 'QDM'. The magnetic bearing to the station.	x	x	x	x	x	x
LO	Define the term 'QDR'. The magnetic bearing from the station.	x	x	x	x	x	x
LO	Define the term 'QUJ'. The true bearing to the station.	x	x	x	x	x	x
LO	Define the term 'QTE'. The true bearing from the station.	x	x	x	x	x	x
LO	Explain that by using more than one ground station, the position of an aircraft can be determined and transmitted to the pilot.	x	x	x	x	x	x
062 02 01 03	**Coverage and range**						
LO	Use the formula: 1.23 × √transmitter height in feet + 1.23 × √receiver height in feet, to calculate the range in NM.	x	x	x	x	x	x
062 02 01 04	**Errors and accuracy**						
LO	Explain why synchronous transmissions will cause errors.	x	x	x	x	x	x
LO	Describe the effect of 'multipath signals'.	x	x	x	x	x	x

LO	Explain that VDF information is divided into the following classes according to ICAO Annex 10: class A: accurate to a range within ± 2°; class B: accurate to a range within ± 5°; class C: accurate to a range within ± 10°; class D: accurate to less than class C.	x	x	x	x	x	x
062 02 02 00	**Non-Directional Beacon (NDB)/ Automatic Direction Finder (ADF)**						
062 02 02 01	**Principles**						
LO	Define the acronym 'NDB'. Non-Directional Beacon.	x	x	x	x	x	x
LO	Define the acronym 'ADF'. Automatic Direction Finder.	x	x	x	x	x	x
LO	State that the NDB is the ground part of the system.	x	x	x	x	x	x
LO	State that the ADF is the airborne part of the system.	x	x	x	x	x	x
LO	State that the NDB operates in the LF and MF frequency bands.	x	x	x	x	x	x
LO	The frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is 190–1 750 kHz.	x	x	x	x	x	x
LO	Define a 'locator beacon'. An LF/MF NDB used as an aid to final approach usually with a range, according to ICAO Annex 10, of 10–25 NM.	x	x	x	x	x	x
LO	Explain the difference between NDBs and locator beacons.	x	x	x	x	x	x
LO	Explain which beacons transmit signals suitable for use by an ADF.	x	x	x	x	x	x
LO	State that certain commercial radio stations transmit within the frequency band of the NDB.	x	x	x	x	x	x
LO	Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave.	x	x	x	x	x	x
LO	Describe the use of NDBs for navigation.	x	x	x	x	x	x
LO	Describe the procedure to identify an NDB station.	x	x	x	x	x	x
LO	Interpret the term 'cone of silence' in respect of an NDB.	x	x	x	x	x	x
LO	State that an NDB station emits a NON/A1A or a NON/A2A signal.	x	x	x	x	x	x

LO	State the function of the Beat Frequency Oscillator (BFO).	x	x	x	x	x	x
LO	State that in order to identify a NON/A1A NDB, the BFO circuit of the receiver has to be activated.	x	x	x	x	x	x
LO	State that the NDB emitting NON/A1A gives rise to erratic indications of the bearing while the station is identifying.	x	x	x	x	x	x
LO	Explain that on modern aircraft the BFO is activated automatically.	x	x	x	x	x	x
062 02 02 02	**Presentation and interpretation**						
LO	Name the types of indicators in common use: electronic navigation display; Radio Magnetic Indicator (RMI); fixed card ADF (radio compass); moving card ADF.	x	x	x	x	x	x
LO	Describe the indications given on RMI, fixed card and moving card ADF displays.	x	x	x	x	x	x
LO	Given a display, interpret the relevant ADF information.	x	x	x	x	x	x
LO	Calculate the true bearing from the compass heading and relative bearing.	x	x	x	x	x	x
LO	Convert the compass bearing into magnetic bearing and true bearing.	x	x	x	x	x	x
LO	Describe how to fly the following in-flight ADF procedures according to ICAO Doc 8168, Volume 1: homing and tracking, and explain the influence of wind; interceptions; procedural turns; holding patterns.	x	x	x	x	x	x
062 02 02 03	**Coverage and range**						
LO	State that the power limits the range of an NDB.	x	x	x	x	x	x
LO	Explain the relationship between power and range.	x	x	x	x	x	x
LO	State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land.	x	x	x	x	x	x

LO	Describe the propagation path of NDB radio waves with respect to the ionosphere and the Earth's surface.	x	x	x	x	x	x
LO	Explain that interference between sky and ground waves at night leads to 'fading'.	x	x	x	x	x	x
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established during approach according to ICAO Doc 8168 as within ± 5°.	x	x	x	x	x	x
LO	State that there is no warning indication of NDB failure.	x	x	x	x	x	x
062 02 02 04	**Errors and accuracy**						
LO	Define 'quadrantal error'. The distortion of the incoming signal from the NDB station by reradiation from the airframe. This is corrected for during installation of the antenna.	x	x	x	x	x	x
LO	Explain 'coastal refraction'. As a radio wave travelling over land crosses the coast, the wave speeds up over water and the wave front bends.	x	x	x	x	x	x
LO	Define 'night/twilight effect'. The influence of sky waves and ground waves arriving at the ADF receiver with a difference of phase and polarisation which introduce bearing errors.	x	x	x	x	x	x
LO	State that interference from other NDB stations on the same frequency may occur at night due to sky-wave contamination.	x	x	x	x	x	x
062 02 02 05	**Factors affecting range and accuracy**						
LO	State that there is no coastal refraction error when: the propagation direction of the wave is 90° to the coastline; the NDB station is sited on the coastline.	x	x	x	x	x	x
LO	State that coastal refraction error increases with increased incidence.	x	x	x	x	x	x
LO	State that night effect predominates around dusk and dawn.	x	x	x	x	x	x
LO	Define 'multipath propagation of the radio wave (mountain effect)'.	x	x	x	x	x	x
LO	State that static emission energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.	x	x	x	x	x	x
062 02 03 00	**VOR and Doppler VOR**						

062 02 03 01	**Principles**						
LO	Explain the operation of VOR using the following general terms: reference phase; variable phase; phase difference.	x	x	x	x	x	x
LO	State that the frequency band allocated to VOR according to ICAO Annex 10 is VHF and the frequencies used are 108.0–117.975 MHz.	x	x	x	x	x	x
LO	State that frequencies within the allocated VOR range which have an odd number in the first decimal place, are used by ILS.	x	x	x	x	x	x
LO	State that the following types of VOR are in operation: Conventional VOR (CVOR): a first-generation VOR station emitting signals by means of a rotating antenna; Doppler VOR (DVOR): a second-generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle; en route VOR for use by IFR traffic; Terminal VOR (TVOR): a station with a shorter range used as part of the approach and departure structure at major airports; Test VOR (VOT): a VOR station emitting a signal to test VOR indicators in an aircraft.	x	x	x	x	x	x
LO	Describe how ATIS information is transmitted on VOR frequencies.	x	x	x	x	x	x
LO	List the three main components of VOR airborne equipment: the antenna, the receiver, the indicator.	x	x	x	x	x	x
LO	Describe the identification of a VOR in terms of Morse-code letters, continuous tone or dots (VOT), tone pitch, repetition rate and additional plain text.	x	x	x	x	x	x
LO	State that according to ICAO Annex 10, a VOR station has an automatic ground monitoring system.	x	x	x	x	x	x

LO	State that the VOR monitoring system monitors change in measured radial and reduction in signal strength.	x	x	x	x	x	x
LO	State that failure of the VOR station to stay within the required limits can cause the removal of identification and navigation components from the carrier or radiation to cease.	x	x	x	x	x	x
062 02 03 02	**Presentation and interpretation**						
LO	Read off the radial on a Radio Magnetic Indicator (RMI).	x	x	x	x	x	x
LO	Read off the angular displacement in relation to a preselected radial on an HSI or CDI.	x	x	x	x	x	x
LO	Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR considering also the heading of the aircraft.	x	x	x	x	x	x
LO	Interpret VOR information as displayed on HSI, CDI and RMI.	x	x	x	x	x	x
LO	Describe the following in-flight VOR procedures as in ICAO Doc 8168, Volume 1: tracking, and explain the influence of wind when tracking; interceptions; procedural turns; holding patterns.	x	x	x	x	x	x
LO	State that when converting a radial into a true bearing, the variation at the VOR station has to be taken into account.	x	x	x	x	x	x
062 02 03 03	**Coverage and range**						
LO	Describe the range with respect to the transmitting power and radio signal.	x	x	x	x	x	x
LO	Calculate the range using the formula: 1.23 × √transmitter height in feet + 1.23 × √receiver height in feet.	x	x	x	x	x	x
062 02 03 04	**Errors and accuracy**						
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established on a VOR track when flying approach procedures according to ICAO Doc 8168 as within half-full scale deflection of the required track.	x	x	x	x	x	x

LO	State that due to reflections from terrain, radials can be bent and lead to wrong or fluctuating indications, which is called 'scalloping'.	x	x	x	x	x	x
LO	State that DVOR is less sensitive to site error than CVOR.	x	x	x	x	x	x
062 02 04 00	**DME**						
062 02 04 01	**Principles**						
LO	State that DME operates in the UHF band between 960–1215 MHz according to ICAO Annex 10.	x	x	x	x	x	x
LO	State that the system comprises two basic components: the aircraft component, the interrogator; the ground component, the transponder.	x	x	x	x	x	x
LO	Describe the principle of distance measurement using DME in terms of: pulse pairs; fixed frequency division of 63 MHz; propagation delay; 50-microsecond delay time; irregular transmission sequence; search mode; tracking mode; memory mode.	x	x	x	x	x	x
LO	State that the distance measured by DME is slant range.	x	x	x	x	x	x
LO	Illustrate that a position line using DME is a circle with the station at its centre.	x	x	x	x	x	x
LO	Describe how the pairing of VHF and UHF frequencies (VOR/DME) enables the selection of two items of navigation information from one frequency setting.	x	x	x	x	x	x
LO	Describe, in the case of co-location, the frequency pairing and identification procedure.	x	x	x	x	x	x
LO	Explain that depending on the configuration, the combination of a DME distance with a VOR radial can determine the position of the aircraft.	x	x	x	x	x	x
LO	Explain that military TACAN stations may be used for DME information.	x	x	x	x	x	x

062 02 04 02	**Presentation and interpretation**						
LO	Explain that when identifying a DME station co-located with a VOR station, the identification signal with the higher-tone frequency is the DME which idents approximately every 40seconds.	x	x	x	x	x	x
LO	Calculate ground distance from given slant range and altitude.	x	x	x	x	x	x
LO	Describe the use of DME to fly a DME arc in accordance with ICAO Doc 8168, Volume 1.	x	x	x	x	x	x
LO	State that a DME system may have a ground speed read-out combined with the DME read-out.	x	x	x	x	x	x
062 02 04 03	**Coverage and range**						
LO	Explain why a ground station can generally respond to a maximum of 100 aircraft.	x	x	x	x	x	x
LO	Explain which aircraft will be denied a DME range first when more than 100 interrogations are being made.	x	x	x	x	x	x
062 02 04 04	**Errors and accuracy**						
LO	State that the error of the DME 'N' according to ICAO Annex 10 should not exceed + 0.25 NM + 1.25 % of the distance measured. For installations installed after 1 January 1989, the total system error should not exceed 0.2 NM DME 'P'.	x	x	x	x	x	x
062 02 04 05	**Factors affecting range and accuracy**						
LO	State that the ground speed read-out combined with DME is only correct when tracking directly to or from the DME station.	x	x	x	x	x	x
LO	State that, close to the station, the ground speed read-out combined with DME is less than the actual ground speed.	x	x	x	x	x	x
062 02 05 00	**ILS**						
062 02 05 01	**Principles**						
LO	Name the three main components of an ILS: the localiser (LLZ); the glide path (GP); range information (markers or DME).	x		x			x

LO	State the site locations of the ILS components: the localiser antenna should be located on the extension of the runway centre line at the stop-end; The glide-path antenna should be located 300 metres beyond the runway threshold, laterally displaced approximately 120 metres to the side of the runway centre line.	x		x			x
LO	Explain that marker beacons produce radiation patterns to indicate predetermined distances from the threshold along the ILS glide path.	x		x			x
LO	Explain that marker beacons are sometimes replaced by a DME paired with the LLZ frequency.	x		x			x
LO	State that in the ILS frequency assigned band 108.0–111.975 MHz, only frequencies which have an odd number in the first decimal, are ILS frequencies.	x		x			x
LO	State that the LLZ operates in the 108,0–111.975 MHz VHF band, according to ICAO Annex 10.	x		x			x
LO	State that the GP operates in the UHF band.	x		x			x
LO	Describe the use of the 90-Hz and the 150-Hz signals in the LLZ and GP transmitters/ receivers, stating how the signals at the receivers vary with angular deviation.	x		x			x
LO	Draw the radiation pattern with respect to the 90-Hz and 150-Hz signals.	x		x			x
LO	Describe how the UHF glide-path frequency is selected automatically by being paired with the LLZ frequency.	x		x			x
LO	Explain the term 'Difference of Depth of Modulation (DDM)'.	x		x			x
LO	State that the difference in the modulation depth increases with displacement from the centre line.	x		x			x
LO	State that both the LLZ and the GP antenna radiate side lobes (false beams) which could give rise to false centre-line and false glide-path indication.	x		x			x
LO	Explain that the back beam from the LLZ antenna may be used as a published 'non-precision approach'.	x		x			x
LO	State that according to ICAO Annex 10 the nominal glide path is 3°.	x		x			x

LO	Name the frequency, modulation and identification assigned to all marker beacons according to ICAO Annex 10: all marker beacons operate on 75-MHz carrier frequency. The modulation frequencies are: outer marker: 400 Hz; middle marker: 1 300 Hz; inner marker: 3 000 Hz. The audio frequency modulation (for identification) is the continuous modulation of the audio frequency and is keyed as follows: outer marker: 2 dashes per second continuously; middle marker: a continuous series of alternate dots and dashes; inner marker: 6 dots per second continuously.	x		x			x
LO	State that according to ICAO Doc 8168, the final-approach area contains a fix or facility that permits verification of the ILS glide path–altimeter relationship. The outer marker or DME is usually used for this purpose.	x		x			x
062 02 05 02	**Presentation and interpretation**						
LO	Describe the ILS identification regarding frequency and Morse code and/or plain text.	x		x			x
LO	Calculate the rate of descent for a 3°-glide-path angle given the ground speed of the aircraft and using the formula: Rate of Descent (ROD) in ft/min = (ground speed in kt × 10) / 2.	x		x			x
LO	Calculate the rate of descent using the following formula when flying any glide-path angle: ROD ft/min = Speed Factor (SF) × glide-path angle × 100.	x		x			x
LO	Interpret the markers by sound, modulation, and frequency.	x		x			x
LO	State that the outer-marker cockpit indicator is coloured blue, the middle marker amber, and the inner marker white.	x		x			x

LO	State that in accordance with ICAO Annex 10, an ILS installation has an automatic ground monitoring system.	x		x			x
LO	State that the LLZ and GP monitoring system monitors any shift in the LLZ and GP mean course line or reduction in signal strength.	x		x			x
LO	State that a failure of either the LLZ or the GP to stay within the predetermined limits will cause: removal of identification and navigation components from the carrier; radiation to cease; a warning to be displayed at the designated control point.	x		x			x
LO	State that an ILS receiver has an automatic monitoring function.	x		x			x
LO	Describe the circumstances in which warning flags will appear for both the LLZ and the GP: absence of the carrier frequency; absence of the 90 and 150-Hz modulation simultaneously; the percentage modulation of either the 90 or 150-Hz signal reduced to 0.	x		x			x
LO	Interpret the indications on a Course Deviation Indicator (CDI) and a Horizontal Situation Indicator (HSI): full-scale deflection of the CDI needle corresponds to approximately 2,5° displacement from the ILS centre line; full-scale deflection on the GP corresponds to approximately 0,7° from the ILS GP centre line.	x		x			x
LO	Interpret the aircraft’s position in relation to the extended runway centre line on a back-beam approach.	x		x			x
LO	Explain the setting of the course pointer of an HSI for front-beam and back-beam approaches.	x		x			x
062 02 05 03	**Coverage and range**						

LO	Sketch the standard coverage area of the LLZ and GP with angular sector limits in degrees and distance limits from the transmitter in accordance with ICAO Annex 10: LLZ coverage area is 10° on either side of the centre line to a distance of 25 NM from the runway, and 35° on either side of the centre line to a distance of 17 NM from the runway; GP coverage area is 8° on either side of the centre line to a distance of minimum 10 NM from the runway.	x		x			x
062 02 05 04	**Errors and accuracy**						
LO	Explain that ILS approaches are divided into facility performance categories defined in ICAO Annex 10.	x		x			x
LO	Define the following ILS operation categories: Category I, Category II, Category IIIA, Category IIIB, Category IIIC.	x		x			x
LO	Explain that all Category-III ILS operations guidance information is provided from the coverage limits of the facility to, and along, the surface of the runway.	x		x			x
LO	Explain why the accuracy requirements are progressively higher for CAT I, CAT II and CAT III ILS.	x		x			x
LO	State the vertical-accuracy requirements above the threshold for CAT I, II and III for the signals of the ILS ground installation.	x		x			x
LO	Explain the following in accordance with ICAO Doc 8168: the accuracy the pilot has to fly the ILS localiser to be considered established on an ILS track is within the half-full scale deflection of the required track; the aircraft has to be established within the half-scale deflection of the LLZ before starting descent on the GP; the pilot has to fly the ILS GP to a maximum of half-scale fly-up deflection of the GP in order to stay in protected airspace.	x		x			x

LO	State that if a pilot deviates by more than half-scale deflection on the LLZ or by more than half-course fly-up deflection on the GP, an immediate missed approach should be executed because obstacle clearance may no longer be guaranteed.	x		x			x
LO	Describe ILS beam bends. Deviations from the nominal position of the LLZ and GP respectively. They are ascertained by flight test.	x		x			x
LO	Explain multipath interference. Reflections from large objects within the ILS coverage area.	x		x			x
062 02 05 05	**Factors affecting range and accuracy**						
LO	Define the 'ILS-critical area'. An area of defined dimensions about the LLZ and GP antennas where vehicles, including aircraft, are excluded during all ILS operations.	x		x			x
LO	Define the 'ILS-sensitive area'. An area extending beyond the critical area where the parking and/or movement of vehicles, including aircraft, is controlled to prevent the possibility of unacceptable interference to the ILS signal during ILS operations.	x		x			x
LO	Describe the effect of FM broadcast stations that transmit on frequencies just below 108 MHz.	x		x			x
062 02 06 00	**Microwave Landing System (MLS)**						
062 02 06 01	**Principles**						
LO	Explain the principle of operation: horizontal course guidance during the approach; vertical guidance during the approach; horizontal guidance for departure and missed approach; DME (DME/P) distance; transmission of special information regarding the system and the approach conditions.	x		x			x
LO	State that MLS operates in the S band on 200 channels.	x		x			x
LO	Explain the reason why MLS can be installed at airports on which, as a result of the effects of surrounding buildings and/or terrain, ILS siting is difficult.	x		x			x
062 02 06 02	**Presentation and interpretation**						

LO	Interpret the display of airborne equipment designed to continuously show the position of the aircraft in relation to a preselected course and glide path along with distance information, during approach and departure.	x		x			x
LO	Explain that segmented approaches can be carried out with a presentation with two cross bars directed by a computer which has been programmed with the approach to be flown.	x		x			x
LO	Illustrate that segmented and curved approaches can only be executed with DME-P installed.	x		x			x
LO	Explain why aircraft are equipped with a Multimode Receiver (MMR) in order to be able to receive ILS, MLS and GPS.	x		x			x
LO	Explain why MLS without DME-P gives an ILS lookalike straight-line approach.	x		x			x
062 02 06 03	**Coverage and range**						
LO	Describe the coverage area for the approach direction as being within a sector of ± 40° of the centre line out to a range of 20 NM from the threshold (according to ICAO Annex 10).	x		x			x
062 02 06 04	**Error and accuracy**						
LO	State the 95 % lateral and vertical accuracy within 20 NM (37 km) of the MLS approach reference datum and 60 ft above the MLS datum point (according to ICAO Annex 10).	x		x			x
062 03 00 00	**RADAR**						
062 03 01 00	**Pulse techniques and associated terms**						
LO	Name the different applications of radar with respect to ATC, MET observations and airborne weather radar.	x	x	x	x	x	x
LO	Describe the pulse technique and echo principle on which primary radar systems are based.	x	x	x	x	x	x
LO	Explain the relationship between the maximum theoretical range and the Pulse Repetition Frequency (PRF).	x	x	x	x	x	x
LO	Calculate the maximum theoretical unambiguous range if the PRF is given using the formula: $\text{Range in km} = \frac{300\,000}{\text{PRF} \times 2}$	x	x	x	x	x	x

LO	Calculate the PRF if the maximum theoretical unambiguous range of the radar is given using the formula: $PRF = \frac{300\,000}{\text{range (km)} \times 2}$	x	x	x	x	x	x
LO	Explain that pulse length defines the minimum theoretical range of a radar.	x	x	x	x	x	x
LO	Explain the need to harmonise the rotation speed of the antenna, the pulse length and the pulse repetition frequency for range.	x	x	x	x	x	x
LO	Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display: atmospheric conditions: superrefraction and subrefraction; attenuation with distance; condition and size of the reflecting surface.	x	x	x	x	x	x
062 03 02 00	**Ground radar**						
062 03 02 01	**Principles**						
LO	Explain that primary radar provides bearing and distance of targets.	x		x	x		x
LO	Explain that primary ground radar is used to detect aircraft that are not equipped with a secondary radar transponder.	x		x	x		x
LO	Explain why Moving Target Indicator (MTI) is used.	x		x	x		x
062 03 02 02	**Presentation and interpretation**						
LO	State that modern ATC systems use computer-generated display.	x		x	x		x
LO	Explain that the radar display enables the ATS controller to provide information, surveillance or guidance service.	x		x	x		x
062 03 03 00	**Airborne weather radar**						
062 03 03 01	**Principles**						
LO	List the two main tasks of the weather radar in respect of weather and navigation.	x		x	x		x
LO	State the wavelength (approx. 3 cm) and frequency of most AWRs (approx. 9 GHz).	x		x	x		x

LO	Explain how the antenna is attitude-stabilised in relation to the horizontal plane using the aircraft's attitude reference system.	x		x	x		x
LO	Explain that older AWRs have two different radiation patterns which can be produced by a single antenna, one for mapping (cosecant-squared) and the other for weather (pencil/cone-shaped).	x		x	x		x
LO	Describe the cone-shaped pencil beam of about 3° to 5° beam width used for weather depiction.	x		x	x		x
LO	Explain that in modern AWRs a single radiation pattern is used for both mapping and weather with the scanning angle being changed between them.	x		x	x		x
062 03 03 02	Presentation and interpretation						
LO	Explain the functions of the following different modes on the radar control panel: off/on switch; function switch, with WX, WX+T and MAP modes; gain-control setting (auto/manual); tilt/autotilt switch.	x		x	x		x
LO	Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red and magenta) indicating the increasing intensity of precipitation.	x		x	x		x
LO	Illustrate the use of azimuth-marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm or to a landmark on the screen.	x		x	x		x
062 03 03 03	Coverage and range						
LO	Explain how the radar is used for weather detection and for mapping (range, tilt and gain, if available).	x		x	x		x
062 03 03 04	Errors, accuracy, limitations						
LO	Explain why AWR should be used with extreme caution when on the ground.	x		x	x		x
062 03 03 05	Factors affecting range and accuracy						
LO	Explain the danger of the area behind heavy rain (shadow area) where no radar waves will penetrate.	x		x	x		x
LO	Explain why the tilt setting should be higher when the aircraft descends to a lower altitude.	x		x	x		x
LO	Explain why the tilt setting should be lower when the aircraft climbs to a higher altitude.	x		x	x		x

LO	Explain why a thunderstorm may not be detected when the tilt is set too high.	x		x	x		x
062 03 03 06	Application for navigation						
LO	Describe the navigation function of the radar in the mapping mode.	x		x	x		x
LO	Describe the use of the weather radar to avoid a thunderstorm (Cb).	x		x	x		x
LO	Explain how turbulence (not CAT) can be detected by a modern weather radar.	x		x	x		x
LO	Explain how windshear can be detected by a modern weather radar.	x		x	x		x
062 03 04 00	**Secondary surveillance radar and transponder**						
062 03 04 01	**Principles**						
LO	Explain that the Air Traffic Control (ATC) system is based on the replies provided by the airborne transponders in response to interrogations from the ATC secondary radar.	x	x	x	x	x	x
LO	Explain that the ground ATC secondary radar uses techniques which provide the ATC with information that cannot be acquired by the primary radar.	x	x	x	x	x	x
LO	Explain that an airborne transponder provides coded-reply signals in response to interrogation signals from the ground secondary radar and from aircraft equipped with TCAS.	x	x	x	x	x	x
LO	Explain the advantages of SSR over a primary radar.	x	x	x	x	x	x
062 03 04 02	**Modes and codes**						
LO	Explain that the interrogator transmits its interrogations in the form of a series of pulses.	x	x	x	x	x	x
LO	Name and explain the interrogation modes: Mode A and C; Intermode: • Mode A/C/S all call, • Mode A/C only all call; Mode S: • Mode S only all call, • broadcast (no reply elicited), • selective.	x	x	x	x	x	x

LO	State that the interrogation frequency is 1 030 MHz and the reply frequency is 1 090 MHz.	x	x	x	x	x	x
LO	Explain that the decoding of the time between the interrogation pulses determines the operating mode of the transponder: Mode A: transmission of aircraft transponder code; Mode C: transmission of aircraft pressure altitude; Mode S: aircraft selection and transmission of flight data for the ground surveillance.	x	x	x	x	x	x
LO	State that the ground interrogation signal is transmitted in the form of pairs of pulses P1 and P3 for Mode A and C, and that a control pulse P2 is transmitted following the first interrogation pulse P1.	x	x	x	x	x	x
LO	Explain that the interval between P1 and P3 determines the mode of interrogation, Mode A or C.	x	x	x	x	x	x
LO	State that the radiated amplitude of P2 from the side lobes and from the main lobe is different.	x	x	x	x	x	x
LO	State that Mode-A designation is a sequence of four digits which can be manually selected from 4 096 available codes.	x	x	x	x	x	x
LO	State that in Mode-C reply the pressure altitude is reported in 100-ft increments.	x	x	x	x	x	x
LO	State that in addition to the information pulses provided, a Special Position Identification (SPI) pulse can be transmitted but only as a result of a manual selection (IDENT).	x	x	x	x	x	x
LO	Explain the need for compatibility of Mode S with Mode A and C.	x	x	x	x	x	x
LO	Explain that Mode-S transponders receive interrogations from other Mode-S transponders and SSR ground stations.	x	x	x	x	x	x
LO	State that Mode-S surveillance protocols implicitly use the principle of selective addressing.	x	x	x	x	x	x
LO	Explain that every aircraft will have been allocated an ICAO Aircraft Address which is hard-coded into the airframe (Mode-S address).	x	x	x	x	x	x
LO	Explain that the ICAO Aircraft Address consists of 24 bits (therefore more than 16 000 000 possible codes) allocated by the registering authority of the State in which the aircraft is registered.	x	x	x	x	x	x

LO	Explain that this (24-bit) address is included in all Mode-S transmissions, so that every interrogation can be directed to a specific aircraft, preventing multiple replies.	x	x	x	x	x	x
LO	State that the ground interrogation signal is transmitted in the form of P1, P3 and P4 pulses for Mode S.	x	x	x	x	x	x
LO	Interpret the following Mode-S terms: selective addressing; mode 'all call'; selective call.	x	x	x	x	x	x
LO	State that Mode-S interrogation contains either: aircraft address; all call address; broadcast address.	x	x	x	x	x	x
LO	Mode A/C/S all-call consists of 3 pulses: P1, P3 and the long P4. A control pulse P2 is transmitted following P1 to suppress responses from aircraft in the side lobes of the interrogation antenna.	x	x	x	x	x	x
LO	Mode A/C only all-call consists of 3 pulses: P1, P3 and the short P4.	x	x	x	x	x	x
LO	State that there are 25 possible Mode-S reply forms.	x	x	x	x	x	x
LO	State that the reply message consists of a preamble and a data block.	x	x	x	x	x	x
LO	State that the Aircraft Address shall be transmitted in any reply except in Mode-S only all-call reply.	x	x	x	x	x	x
LO	Explain that Mode S can provide enhanced vertical tracking, using a 25-feet altitude increment.	x	x	x	x	x	x
LO	Explain how SSR can be used for ADS B.	x	x	x	x	x	x
062 03 04 03	**Presentation and interpretation**						
LO	Explain how an aircraft can be identified by a unique code.	x	x	x	x	x	x

LO	Illustrate how the following information is presented on the radar screen: pressure altitude; flight level; flight number or aircraft registration; ground speed.	x	x	x	x	x	x
LO	Name and interpret the codes 7700, 7600 and 7500.	x	x	x	x	x	x
LO	Interpret the selector modes: OFF, Standby, ON (mode A), ALT (mode A and C), and TEST.	x	x	x	x	x	x
LO	Explain the function of the emission of a Special Position Identification (SPI) pulse after pushing the ident button in the aircraft.	x	x	x	x	x	x
	Elementary surveillance						
LO	Explain that the elementary surveillance provides the ATC controller with the aircraft's position, altitude and identification.	x	x	x	x	x	x
LO	State that the elementary surveillance needs Mode-S transponders with Surveillance Identifier (SI) code capacity and the automatic reporting of aircraft identification, known as ICAO Level 2s.	x	x	x	x	x	x
LO	State that the SI code must correspond to the aircraft identification specified in item 7 of the ICAO flight plan or to the registration marking.	x	x	x	x	x	x
LO	State that only the ICAO identification format is compatible with the ATS ground system.	x	x	x	x	x	x
LO	State that Mode-S-equipped aircraft with a maximum mass in excess of 5 700 kg or a maximum cruising true airspeed capability in excess of 250 kt must operate with transponder antenna diversity.	x	x	x	x	x	x
LO	Describe the different types of communication protocols (A, B, C and D).	x	x	x	x	x	x
LO	Explain that elementary surveillance is based on Ground-Initiated Comm-B protocols.	x	x	x	x	x	x
	Enhanced surveillance						

LO	State that enhanced surveillance consists of the extraction of additional aircraft parameters known as Downlink Aircraft Parameters (DAP) consisting of: magnetic heading; indicated airspeed; Mach number; vertical rate; roll angle; track angle rate; true track angle; ground speed; selected altitude.	x	x	x	x	x	x
LO	Explain that the controller's information is improved by providing actual aircraft-derived data such as magnetic heading, indicated airspeed, vertical rate and selected altitude.	x	x	x	x	x	x
LO	Explain that the automatic extraction of an aircraft's parameters, and their presentation to the controller, will reduce their R/T workload and will free them to concentrate on ensuring the safe and efficient passage of air traffic.	x	x	x	x	x	x
LO	Explain that the reduction in radio-telephony between the air traffic controllers and the pilots will reduce pilot workload and remove a potential source of error.	x	x	x	x	x	x
062 03 04 04	**Errors and accuracy**						
LO	Explain the following disadvantages of SSR (Mode A/C): code garbling of aircraft less than 1.7 NM apart measured in the vertical plane perpendicular to and from the antenna; 'fruiting' which results from the reception of replies caused by interrogations from other radar stations.	x	x	x	x	x	x
062 04 00 00	**INTENTONALLY LEFT BLANK**						
062 05 00 00	**AREA NAVIGATION SYSTEMS, RNAV/FMS**						
062 05 01 00	**General philosophy and definitions**						
062 05 01 01	**Basic RNAV (B-RNAV), Precision RNAV (P-RNAV), RNP-PNAV**						

LO	Define 'Area Navigation' (RNAV) (ICAO Annex 11). A method of navigation permitting aircraft operations on any desired track within the coverage of station-referenced navigation signals, or within the limits of a self-contained navigation system.	x		x			x
LO	State that Basic RNAV (B-RNAV) systems require RNP 5.	x		x			x
LO	State that Precision RNAV (P-RNAV) systems require RNP 1.	x		x			x
062 05 01 02	**Principles of 2D RNAV, 3D RNAV and 4D RNAV**						
LO	State that a 2D-RNAV system is able to navigate in the horizontal plane only.	x		x			x
LO	State that a 3D-RNAV system is able to navigate in the horizontal plane and in addition has a guidance capability in the vertical plane.	x		x			x
LO	State that a 4D-RNAV system is able to navigate in the horizontal plane, has a guidance capability in the vertical plane and in addition has a timing function.	x		x			x
062 05 01 03	**Required Navigation Performance (RNP) in accordance with ICAO Doc 9613**						
LO	State that RNP is a concept that applies to navigation performance within an airspace.	x		x			x
LO	The RNP type is based on the navigation performance accuracy to be achieved within anairspace.	x		x			x
LO	State that RNP X requires a navigation performance accuracy of ± X NM both lateral and longitudinal 95 % of the flying time (RNP 1 requires a navigation performance of ± 1 NM both lateral and longitudinal 95 % of the flying time).	x		x			x
LO	State that RNAV equipment is one requirement in order to receive approval to operate in an RNP environment.	x		x			x
LO	State that RNAV equipment operates by automatically determining the aircraft's position.	x		x			x

LO	State the advantages of using RNAV techniques over more conventional forms of navigation: establishment of more direct routes permitting a reduction in flight distance; establishment of dual or parallel routes to accommodate a greater flow of en route traffic; establishment of bypass routes for aircraft overflying high-density terminal areas; establishment of alternatives or contingency routes either on a planned or ad hoc basis; establishment of optimum locations for holding patterns; reduction in the number of ground navigation facilities.	x		x			x
LO	State that RNP may be specified for a route, a number of routes, an area, volume of airspace, or any airspace of defined dimensions.	x		x			x
LO	State that airborne navigation equipment uses inputs from navigational systems such as VOR/DME, DME/DME, GNSS, INS and IRS.	x		x			x
LO	State that aircraft equipped to operate to RNP 1 and better, should be able to compute an estimate of its position error, depending on the sensors being used and time elapsed.	x		x			x
LO	Indicate navigation-equipment failure.	x		x			x
062 05 02 00	**Simple 2D RNAV** **Info: First generation of radio-navigation systems allowing the flight crew to select a phantom waypoint on the RNAV panel and select a desired track to fly inbound to the waypoint.**						
062 05 02 01	**Flight-deck equipment**						

LO	The control unit allows the flight crew to: tune the VOR/DME station used to define the phantom waypoint; define the phantom waypoint as a radial and distance (DME) from the selected VOR/DME station; select the desired magnetic track to follow inbound to the phantom waypoint; select between an en route mode, an approach mode of operation and the basic VOR/DME mode of operation.	x		x			x
LO	Track guidance is shown on the HSI/CDI.	x		x			x
062 05 02 02	**Navigation computer, VOR/DME navigation**						
LO	The navigation computer of the simple 2D-RNAV system computes the navigational problems by simple sine and cosine mathematics, solving the triangular problems.	x		x			x
062 05 02 03	**Navigation computer input/output**						
LO	State that the following input data to the navigation computer is: the actual VOR radial and DME distance from the selected VOR station; the radial and distance to phantom waypoint; the desired magnetic track inbound to the phantom waypoint.	x		x			x
LO	State the following output data from the navigation computer: desired magnetic track to the phantom waypoint shown on the CDI at the course pointer; distance from the present position to the phantom waypoint; deviations from the desired track as follows: in en route mode, full-scale deflection on the CDI is 5 NM; in approach mode, full-scale deflection on the CDI is 1 ¼ NM; in VOR/DME mode, full-scale deflection on the CDI is 10°.	x		x			x
LO	State that the system is limited to operate within the range of the selected VOR/DME station.	x		x			x

062 05 03 00	**4D RNAV** Info: The next generation of area navigation equipment allowed the flight crew to navigate on any desired track within the coverage of VOR/DME stations.						
062 05 03 01	**Flight-deck equipment**						
LO	State that in order to give the flight crew control over the required lateral guidance functions, RNAV equipment should at least be able to perform the following functions: display present position in latitude/ longitude or as distance/bearing to the selected waypoint; select or enter the required flight plan through the Control and Display Unit (CDU); review and modify navigation data for any part of a flight plan at any stage of flight and store sufficient data to carry out the active flight plan; review, assemble, modify or verify a flight plan in flight, without affecting the guidance output; execute a modified flight plan only after positive action by the flight crew; where provided, assemble and verify an alternative flight plan without affecting the active flight plan; assemble a flight plan, either by identifier or by selection of individual waypoints from the database, or by creation of waypoints from the database, or by creation of waypoints defined by latitude/longitude, bearing/ distance parameters or other parameters; assemble flight plans by joining routes or route segments; allow verification or adjustment of displayed position; provide automatic sequencing through waypoints with turn anticipation; manual sequencing should also be provided to allow flight over, and return to, waypoints; display cross-track error on the CDU; provide time to waypoints on the CDU; execute a direct clearance to any waypoint; fly parallel tracks at the selected offset distance; offset mode should be clearly indicated; purge previous radio updates;	x		x			x

	carry out RNAV holding procedures (when defined); make available to the flight crew estimates of positional uncertainty, either as a quality factor or by reference to sensor differences from the computed position; conform to WGS-84 geodetic reference system; indicate navigation-equipment failure.						
062 05 03 02	**Navigation computer, VOR/DME navigation**						
LO	State that the navigation computer uses signals from the VOR/DME stations to determine position.	x		x			x
LO	Explain that the system automatically tunes the VOR/DME stations by selecting stations which provide the best angular fix determination.	x		x			x
LO	Explain that the computer uses DME/DME to determine position if possible, and only if two DMEs are not available the system will use VOR/DME to determine the position of the aircraft.	x		x			x
LO	Explain that the computer is navigating on the great circle between waypoints inserted into the system.	x		x			x
LO	State that the system has a navigational database which may contain the following elements: reference data for airports (4-letter ICAO identifier); VOR/DME station data (3-letter ICAO identifier); waypoint data (5-letter ICAO identifier); STAR data; SID data; airport runway data including thresholds and outer makers; NDB stations (alphabetic ICAO identifier); company flight-plan routes.	x		x			x
LO	State that the navigational database is valid for a limited time, usually 28 days.	x		x			x
LO	State that the navigational database is read only, but additional space exists so that crew-created navigational data may be saved in the computer memory. Such additional data will also be deleted at the 28-day navigational update of the database.	x		x			x

LO	State that the computer receives a TAS input from the air-data computer and a heading input in order to calculate actual wind velocity.	x		x			x
LO	State that the computer calculates track error in relation to desired track. This data can easily be interfaced with the automatic flight control, and when done so, it enables the aircraft to automatically follow the flight plan loaded into the RNAV computer.	x		x			x
LO	State that the computer is able to perform great-circle navigation when receiving VOR/DME stations. If out of range, the system reverts to DR (Dead Reckoning) mode, where it updates the position by means of last computed wind and TAS and heading information. Operation in DR mode is time-limited.	x		x			x
LO	State that the system has 'direct to' capability to any waypoint.	x		x			x
LO	State that the system is capable of parallel offset tracking.	x		x			x
LO	State that any waypoint can be inserted into the computer in one of the following ways: alphanumeric ICAO identifier; latitude and longitude; radial and distance from a VOR station.	x		x			x
062 05 03 03	**Navigation computer input/output**						
LO	State that the following are input data into a 4D-RNAV system: DME distances from DME stations; radial from a VOR station; TAS and altitude from the air-data computer; heading from the aircraft's heading system.	x		x			x
LO	State that the following are output data from a 4D-RNAV system: distance to any waypoint; estimated time overhead; ground speed and TAS; true wind; track error.	x		x			x

062 05 04 00	**Flight Management System (FMS) and general terms**						
062 05 04 01	**Navigation and flight management**						
LO	Explain that the development of computers which combine reliable liquid crystal displays offer the means of accessing more data and displaying them to the flight crew.	x		x			x
LO	Explain that a flight management system has the ability to monitor and direct both navigation and performance of the flight.	x		x			x
LO	Explain the two functions common to all FMS systems: automatic navigation Lateral Navigation (LNAV); flight path management Vertical Navigation (VNAV).	x		x			x
LO	Name the main components of the FMS system as being: Flight Management Computer (FMC); Control and Display Unit (CDU); symbol generator; Electronic Flight Instrument System (EFIS) consisting of the NAV display, including mode selector and attitude display; Auto-throttle (A/T) and Flight Control Computer (FCC).	x		x			x
062 05 04 02	**Flight management computer**						
LO	State that the centre of the flight management system is the FMC with its stored navigation and performance data.	x		x			x
062 05 04 03	**Navigation database**						

LO	State that the navigation database of the FMC may contain the following data: reference data for airports (4-letter ICAO identifier); VOR/DME station data (3-letter ICAO identifier); waypoint data (5-letter ICAO identifier); STAR data; SID data; holding patterns; airport runway data; NDB stations (alphabetic ICAO identifier); company flight-plan routes.	x		x			x
LO	State that the navigation database is updated every 28 days.	x		x			x
LO	State that the navigational database is write-protected, but additional space exists so that crew-created navigational data may be saved in the computer's memory. Such additional data will also be deleted at the 28-day navigational update of the database.	x		x			x
062 05 04 04	**Performance database**						
LO	State that the performance database stores all the data relating to the specific aircraft/engine configuration, and is updated by ground staff when necessary.	x		x			x
LO	State that the performance database of the FMC contain the following data: V1, VR and V2 speeds; aircraft drag; engine-thrust characteristics; maximum and optimum operating altitudes; speeds for maximum and optimum climb; speeds for long-range cruise, maximum endurance and holding; maximum Zero-Fuel Mass (ZFM), maximum Take-Off Mass (TOM) and maximum Landing Mass (LM); fuel-flow parameters; aircraft flight envelope.	x		x			x

062 05 04 05	**Typical input/output data from the FMC**						
LO	State the following are typical input data to the FMC: time; fuel flow; total fuel; TAS, altitude, vertical speed, Mach number and outside-air temperature from the Air-Data Computer (ADC); DME and radial information from the VHF/NAV receivers; air/ground position; flap/slat position; IRS and GPS positions; Control and Display Unit (CDU) entries.	x		x			x
LO	State that the following are typical output data from the FMC: command signals to the flight directors and autopilot; command signals to the auto-throttle; information to the EFIS displays through the symbol generator; data to the CDU and various annunciators.	x		x			x
062 05 04 06	**Determination of the FMS position of the aircraft**						
LO	State that modern FMS may use a range of sensors for calculating the position of the aircraft including VOR, DME, GPS, IRS and ILS.	x		x			x
LO	State that the information from the sensors used may be blended into a single position by using the Kalman-filter method.	x		x			x
LO	State that the Kalman filter is an algorithm for filtering incomplete and noisy measurements of dynamical processes so that errors of measurements from different sensors are minimised, thus leading to the calculated position being more accurate than that produced by any single sensor.	x		x			x
062 05 05 00	**Typical flight-deck equipment fitted on FMS aircraft**						
062 05 05 01	**Control and Display Unit (CDU)**						
LO	State that the communication link between the flight crew and the FMC is the CDU.	x		x			x

LO	Explain the main components of the CDU as follows: CDU display including the following terms: page title, data field, scratch pad; line-select keys; numeric keys; alpha keys; function and mode keys used to select specific data pages on the CDU display, to execute orders or to navigate to pages through the data presented; warning lights, message light and offset light.	x		x			x
062 05 05 02	**EFIS instruments (attitude display, navigation display)**						
LO	State that FMS-equipped aircraft typically has two displays on the instrument panel in front of each pilot.	x		x			x
LO	State that the following data are typically displayed on the attitude display: attitude information; flight director command bars; radio height and barometric altitude; course deviation indication; glide-path information (when an ILS is tuned); speed information.	x		x			x
062 05 05 03	**Typical modes of the navigation display**						
LO	State the following typical modes of the navigation display: full VOR/ILS mode showing the whole compass rose; expanded (arc) VOR/ILS mode showing the forward 90° sector; map mode; plan mode.	x		x			x
062 05 05 04	**Typical information on the navigation display**						

LO	List and interpret the following information typically shown on a navigation display in 'Full VOR/ILS' mode: the map display will be in full VOR mode when a VOR frequency is selected, and full ILS mode when an ILS frequency is selected on the VHF NAV frequency selector; DME distance to selected DME station; a full 360° compass rose. At the top of the compass rose, present heading is indicated and shown as digital numbers in a heading box. Next to the heading box it is indicated whether the heading is true or magnetic. True heading is available on aircraft with IRS. A triangle (different symbols are used on different aircraft) on the compass rose indicates present track. Track indication is only available when the FMC navigation computer is able to compute the aircraft's position. A square symbol on the outside of the compass rose indicates the selected heading for the autopilot, and if 'heading select' mode is activated on the autopilot, this is the heading the aircraft will turn to. Within the compass rose, a CDI is shown. On the CDI, the course pointer points to the selected VOR/ILS course SET on the OBS. On the CDI, the course deviation bar will indicate angular deflection from the selected VOR/ILS track. Full-scale deflection side to side in VOR mode is 20°, and 5° in ILS mode. In VOR mode, a TO/FROM indication is shown on the display. The selected ILS/VOR frequency is shown. ILS or VOR mode is shown according to the selected frequency. If an ILS frequency is selected, a glide-path deviation scale is shown.	x		x			x

LO	A wind arrow indicating wind direction according to the compass rose, and velocity in numbers next to the arrow.	x		x			x
LO	Given an EFIS navigation display in full VOR/ILS mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; selected course; actual radial; left or right of selected track; above or below the glide path; distance to the DME station; selected heading for the autopilot heading select bug; determine whether the display is in VOR or ILS rose mode.	x		x			x
LO	Given an EFIS navigation display in expanded VOR/ILS mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; tailwind/headwind; wind velocity; selected course; actual radial; left or right of selected track; above or below the glide path; distance to the DME station; selected heading for the autopilot heading select bug; state whether the display is in VOR or ILS rose mode.	x		x			x

LO	Given an EFIS navigation display in map mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; tailwind/headwind; wind velocity; left or right of the FMS track; distance to active waypoint; ETO next waypoint; selected heading for the autopilot heading select bug; determine whether a depicted symbol is a VOR/DME station or an airport; determine whether a specific waypoint is part of the FMS route.	x		x			x
LO	Given an EFIS navigation display in plan mode, read off the following information: heading (magnetic/true) track (magnetic/true) drift; wind correction angle; distance to active waypoint; ETO active waypoint; state the selected heading for the autopilot heading select bug; measure and state true track of specific FMS route track.	x		x			x
062 06 00 00	**GLOBAL NAVIGATION SATELLITE SYSTEMS**						
062 06 01 00	**GPS, GLONASS, GALILEO**						
062 06 01 01	**Principles**						

LO	State that there are two main Global Navigation Satellite Systems (GNSS) currently in existence with a third one which is planned to be fully operational by 2011. These are: USA NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS); Russian GLObal NAvigation Satellite System (GLONASS); European GALILEO.	x	x	x	x	x	x
LO	State that all three systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position.	x	x	x	x	x	x
062 06 01 02	**Operation**						
	NAVSTAR GPS						
LO	State that there are currently two modes of operation: Standard Positioning Service (SPS) for civilian users, and Precise Positioning Service (PPS) for authorised users.	x	x	x	x	x	x
LO	SPS was originally designed to provide civilian users with a less accurate positioning capability than PPS.	x	x	x	x	x	x
LO	Name the three segments as follows: space segment; control segment; user segment.	x	x	x	x	x	x
	Space segment						
LO	State that the space segment consists of a notional constellation of 24 operational satellites.	x	x	x	x	x	x
LO	State that the satellites are orbiting the Earth in orbits inclined 55° to the plane of the equator.	x	x	x	x	x	x
LO	State that the satellites are in a nearly circular orbit of the Earth at an altitude of 20 200 km (10 900 NM).	x	x	x	x	x	x
LO	State that the satellites are distributed in 6 orbital planes with at least 4 satellites in each.	x	x	x	x	x	x
LO	State that a satellite completes an orbit in approximately 12 hours.	x	x	x	x	x	x
LO	State that each satellite broadcasts ranging signals on two UHF frequencies: L1 1575.42 MHz and L2 1227.6 MHz.	x	x	x	x	x	x

LO	State that SPS is a positioning and timing service provided on frequency L1.	x	x	x	x	x	x
LO	State that PPS uses both frequencies L1 and L2.	x	x	x	x	x	x
LO	In 2005, the first replacement satellite was launched with a new military M code on the L1 frequency, and a second signal for civilian use L2C on the L2 frequency.	x	x	x	x	x	x
LO	State that the ranging signal contains a Coarse Acquisition (C/A) code and a navigational data message.	x	x	x	x	x	x
LO	State that the navigation message contains: almanac data; ephemeris; satellite clock correction parameters; UTC parameters; ionospheric model; satellite health data.	x	x	x	x	x	x
LO	State that it takes 12,5 minutes for a GPS receiver to receive all the data frames in the navigation message.	x	x	x	x	x	x
LO	State that the almanac contains the orbital data about all the satellites in the GPS constellation.	x	x	x	x	x	x
LO	State that the ephemeris contains data used to correct the orbital data of the satellites due to small disturbances.	x	x	x	x	x	x
LO	State that the clock correction parameters are data for the correction of the satellite time.	x	x	x	x	x	x
LO	State that UTC parameters are factors determining the difference between GPS time and UTC.	x	x	x	x	x	x
LO	State that an ionospheric model is currently used to calculate the time delay of the signal travelling through the ionosphere.	x	x	x	x	x	x
LO	State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data.	x	x	x	x	x	x
LO	State that GPS uses the WGS-84 model.	x	x	x	x	x	x
LO	State that two codes are transmitted on the L1 frequency, namely a C/A code and a Precision (P) code. The P code is not used for SPS.	x	x	x	x	x	x

LO	State that the C/A code is a Pseudo Random Noise (PRN) code sequence, repeating every millisecond. Each C/A code is unique and provides the mechanism to identify each satellite.	x	x	x	x	x	x
LO	State that satellites broadcast the PRN codes with reference to the satellite vehicle time which are subsequently changed by the receiver to UTC.	x	x	x	x	x	x
LO	State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference.	x	x	x	x	x	x
	Control segment						
LO	State that the control segment comprises: a master control station; ground antenna; monitoring stations.	x	x	x	x	x	x
LO	State that the master control station is responsible for all aspects of the constellation command and control.	x	x	x	x	x	x
LO	State that the main tasks of the control segment are: managing SPS performance; navigation data upload; monitoring satellites.	x	x	x	x	x	x
	User segment						
LO	State that GPS supplies three-dimensional position fixes and speed data, plus a precise time reference.	x	x	x	x	x	x
LO	State that the GPS receiver used in aviation is a multichannel type.	x	x	x	x	x	x
LO	State that a GPS receiver is able to determine the distance to a satellite by determining the difference between the time of transmission by the satellite and the time of reception.	x	x	x	x	x	x
LO	State that the initial distance calculated to the satellites is called pseudo-range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range.	x	x	x	x	x	x
LO	State that each range defines a sphere with its centre at the satellite.	x	x	x	x	x	x
LO	State that three satellites are needed to determine a two-dimensional position.	x	x	x	x	x	x

LO	State that four spheres are needed to calculate a three-dimensional position, hence four satellites are required.	x	x	x	x	x	x
LO	State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites.	x	x	x	x	x	x
LO	State that the receiver is able to calculate aircraft ground speed using the SV Doppler frequency shift and/or the change in receiver position over time.	x	x	x	x	x	x
	NAVSTAR GPS integrity						
LO	Define 'Receiver Autonomous Integrity Monitoring (RAIM)'. A technique whereby a receiver processor determines the integrity of the navigation signals.	x	x	x	x	x	x
LO	State that RAIM is achieved by consistency check among pseudo-range measurements.	x	x	x	x	x	x
LO	State that basic RAIM requires five satellites. A sixth is for isolating a faulty satellite from the navigation solution.	x	x	x	x	x	x
LO	State that when a GPS receiver uses barometric altitude as an augmentation to RAIM, the number of satellites needed for the receiver to perform the RAIM function may be reduced by one.	x	x	x	x	x	x
	GLONASS						
LO	List the three components of GLONASS: space segment, which contains the constellation of satellites; control segment, which contains the ground-based facilities; user segment, which contains the user equipment.	x	x	x	x	x	x
LO	State the composition of the constellation in the 'space segment': 24 satellites in 3 orbital planes with 8 equally displaced by 45° of latitude; a near-circular orbit at 19 100 km at an inclination of 64.8° to the equator; each orbit is completed in 11 hours and 15 minutes.	x	x	x	x	x	x
LO	State that the control segment provides: monitoring of the constellation status; correction to orbital parameters; navigation data uploading.	x	x	x	x	x	x

LO	State that the user equipment consists of receivers and processors for the navigation signals for the calculation of the coordinates, velocity and time.	x	x	x	x	x	x
LO	State that the time reference is UTC.	x	x	x	x	x	x
LO	State that the datum used is PZ-90 Earth-centred Earth-fixed.	x	x	x	x	x	
LO	State that each satellite transmits navigation signals on two frequencies of L-band, L1 1.6 GHz and L2 1.2 GHz.	x	x	x	x	x	x
LO	State that L1 is a standard-accuracy signal designed for civilian users worldwide and L2 is a high-accuracy signal modulated by a special code for authorised users only.	x	x	x	x	x	x
LO	State that the navigation message has a duration of 2 seconds and contains 'immediate' data which relates to the actual satellite transmitting the given navigation signal and 'non-immediate' data which relates to all other satellites within the constellation.	x	x	x	x	x	x
LO	State that 'immediate data' consists of: enumeration of the satellite time marks; difference between onboard time scale of the satellite and GLONASS time; relative differences between carrier frequency of the satellite and its nominal value; ephemeris parameters.	x	x	x	x	x	x
LO	State that 'non-immediate' data consists of: data on the status of all satellites within the space segment; coarse corrections to onboard time scales of each satellite relative to GLONASS time; orbital parameters of all satellites within the space segment; correction to GLONASS time relative to UTC (must remain within 1 microsecond).	x	x	x	x	x	x
LO	State that integrity monitoring includes checking the quality of the characteristics of the navigation signal and the data within the navigation message.	x	x	x	x	x	x

LO	State that integrity monitoring is implemented in two ways: Continuous automatic operability monitoring of principal systems in each satellite. If a malfunction occurs, an 'unhealthy' flag appears within the 'immediate data' of the navigation message. Special tracking stations within the ground-based control segment are used to monitor the space-segment performance. If a malfunction occurs, an 'unhealthy' flag appears within the 'immediate data' of the navigation message.	x	x	x	x	x	x
LO	State that agreements have been concluded between the appropriate agencies for the interoperability by any approved user of NAVSTAR and GLONASS systems.	x	x	x	x	x	x
	GALILEO						
LO	State that the core of the Galileo constellation will consist of 30 satellites with 9 plus a spare replacement in each of the 3 planes in near-circular orbit at an altitude of 23 222 km inclined at 56° to the plane of the equator.	x	x	x	x	x	x
LO	State that the signals will be transmitted in 3 frequency bands: 1 164–1 215 MHz, 1 260–1 300 MHz and 1 559–1 591 MHz (1 559–1 591 MHz will be shared with GPS on a non-interference basis).	x	x	x	x	x	x
LO	State that each orbit will take 14 hours.	x	x	x	x	x	x
LO	State that each satellite has three sections: timing, signal generation and transmit.	x	x	x	x	x	x
LO	State that in the 'timing section' two clocks have been developed, a Rubidium Frequency Standard clock and a more precise Passive Hydrogen Maser clock.	x	x	x	x	x	x
LO	State that the signal generation contains the navigation signals.	x	x	x	x	x	x
LO	State that the navigation signals consist of a ranging-code identifier and the navigation message.	x	x	x	x	x	x
LO	State that the navigation message basically contains information concerning the satellite orbit (ephemeris) and the clock references.	x	x	x	x	x	x
LO	State that the navigation message is 'up-converted' on four navigation signal carriers and the outputs are combined in a multiplexer before transmission in the transmit section.	x	x	x	x	x	x

LO	State that the navigation antenna has been designed to minimise interference between satellites by having equal power level propagation paths independent of elevation angle.	x	x	x	x	x	x
LO	State that the system is monitored in a similar way for both GPS NAVSTAR and GLONASS, but also by a new method based on spread-spectrum signals.	x	x	x	x	x	x
LO	State that tracking, telemetry and command operations are controlled by sophisticated data encryption and authentication procedures.	x	x	x	x	x	x
LO	GPS, EGNOS and GALILEO are compatible, will not interfere with each other, and the performance of the receiver will be enhanced by the interoperability of the systems.	x	x	x	x	x	x
	GALILEO future developments **Info: Further LOs will be written as details are released.**						
062 06 01 03	**Errors and factors affecting accuracy**						
LO	List the most significant factors affecting accuracy: ionospheric propagation delay; dilution of position; satellite clock error; satellite orbital variations; multipath.	x	x	x	x	x	x
LO	State that Ionospheric Propagation Delay (IPD) can almost be eliminated by using two frequencies.	x	x	x	x	x	x
LO	State that in SPS receivers, IPD is currently corrected by using the ionospheric model from the navigation message, but the error is only reduced by 50 %.	x	x	x	x	x	x
LO	State that ionospheric delay is the most significant error.	x	x	x	x	x	x
LO	State that dilution of position arises from the geometry and number of satellites in view. It is called Position Dilution of Precision (PDOP).	x	x	x	x	x	x
LO	State that errors in the satellite orbits are due to: solar wind; gravitation of the Sun, Moon and planets.	x	x	x	x	x	x

LO	State that multipath is when the signal arrives at the receiver via more than one path (the signal being reflected from surfaces near the receiver).	x	x	x	x	x	x
062 06 02 00	**Ground, satellite and airborne-based augmentation systems**						
062 06 02 01	**Ground-Based Augmentation Systems (GBAS)**						
LO	Explain the principle of a GBAS: to measure on ground the signal errors transmitted by GNSS satellites and relay the measured errors to the user for correction.	x	x	x	x	x	x
LO	State that the ICAO GBAS standard is based on this technique through the use of a data link in the VHF band of ILS–VOR systems (108–118 MHz).	x	x	x	x	x	x
LO	State that for a GBAS station the coverage is about 30 km.	x	x	x	x	x	x
LO	Explain that ICAO Standards provide the possibility to interconnect GBAS stations to form a network broadcasting large-scale differential corrections. Such a system is identified as Ground Regional Augmentation System (GRAS).	x	x	x	x	x	x
LO	Explain that GBAS ground subsystems provide two services: precision approach service and GBAS positioning service. The precision approach service provides deviation guidance for final-approach Segments, while the GBAS positioning service provides horizontal position information to support RNAV operations in terminal areas.	x	x	x	x	x	x
LO	Explain that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with approach data, corrections and integrity information for GNSS satellites in view via a VHF Data Broadcast (VDB).	x	x	x	x	x	x
LO	State that the minimum GBAS plan coverage is 15 NM from the landing threshold point within 35° apart the final approach path and 10° apart between 15 and 20 NM.	x	x	x	x	x	x
LO	State that GBAS based on GPS is sometimes called Local Area Augmentation System (LAAS).	x	x	x	x	x	x

LO	Describe the characteristics of a Local Area Augmentation System (LAAS) with respect to: differential corrections applied to a satellite signal by a ground-based reference station; regional service providers to compute the integrity of the satellite signals over their region; extra accuracy for extended coverage around airports, railways, seaports and urban areas as required by the user.	x	x	x	x	x	x
062 06 02 02	**Satellite-Based Augmentation Systems (SBAS)**						
LO	Explain the principle of a SBAS: to measure on the ground the signal errors transmitted by GNSS satellites and transmit differential corrections and integrity messages for navigation satellites.	X	x	x	x	x	x
LO	State that the frequency band of the data link is identical to that of the GPS signals.	X	x	x	x	x	x
LO	Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas.	X	x	x	x	x	x
LO	Explain that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites.	X	x	x	x	x	x
LO	State that SBAS consists of three elements: the ground infrastructure (monitoring and processing stations); the SBAS satellites; the SBAS airborne receivers.	X	x	x	x	x	x
LO	Explain that the SBAS station network measures the pseudo-range between the ranging source and an SBAS receiver at the known locations and provides separate corrections for ranging source ephemeris errors, clock errors and ionospheric errors. The user applies corrections for tropospheric delay.	X	x	x	x	x	x
LO	Explain that SBAS can provide approach and landing operations with vertical guidance (APV) and precision approach service.	X	x	x	x	x	x
LO	Explain the difference between ‘coverage area’ and ‘service area’.	X	x	x	x	x	x

LO	State that Satellite-Based Augmentation Systems include: EGNOS in western Europe and the Mediterranean; WAAS in the USA; MSAS in Japan; GAGAN in India.	X	x	x	x	x	x
LO	Explain that SBAS systems regionally augment GPS and GLONASS by making them suitable for safety-critical applications such as landing aircraft.	X	x	x	x	x	x
062 06 02 03	**European Geostationary Navigation Overlay Service (EGNOS)**						
LO	State that EGNOS consists of three geostationary Inmarsat satellites which broadcast GPS lookalike signals.	X	x	x	x	x	x
LO	State that EGNOS is designed to improve accuracy to 1–2 m horizontally and 3–5 m vertically.	X	x	x	x	x	x
LO	Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hours GPS alone).	X	x	x	x	x	x
062 06 02 04	**Airborne-Based Augmentation Systems (ABAS)**						
LO	Explain the principle of ABAS: to use redundant elements within the GPS constellation (e.g.: multiplicity of distance measurements to various satellites) or the combination of GNSS measurements with those of other navigation sensors (such as inertial systems) in order to develop integrity control.	x	x	x	x	x	x
LO	State that the type of ABAS using only GNSS information is named Receiver Autonomous Integrity Monitoring (RAIM).	x	x	x	x	x	x
LO	State that a system using information from additional onboard sensors is named Aircraft Autonomous Integrity Monitoring (AAIM).	x	x	x	x	x	x
LO	Explain that the typical sensors used are barometric altimeter, clock and inertial navigation system.	x	x	x	x	x	x
LO	Explain that unlike GBAS and SBAS, ABAS does not improve positioning accuracy.	x	x	x	x	x	x

L. SUBJECT 070 — OPERATIONAL PROCEDURES

[

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
070 00 00 00	**OPERATIONAL PROCEDURES**						
071 01 00 00	**GENERAL REQUIREMENTS**						
071 01 01 00	**ICAO Annex 6**						
071 01 01 01	**Definitions**						
LO	Alternate aerodrome: take-off alternate, en route alternate, ETOPS en route alternate, destination alternate (ICAO Annex 6, Part I, Chapter 1).	x	x				
LO	Alternate heliport (ICAO Annex 6, Part III, Section 1, Chapter 1).			x	x	x	
LO	Flight time — aeroplanes (ICAO Annex 6, Part I, Chapter 1).	x	x				
LO	Flight time — helicopters (ICAO Annex 6, Part III, Section 1, Chapter 1).			x	x	x	
071 01 01 02	**Applicability**						
LO	State that Part I shall be applicable to the operation of aeroplanes by operators authorised to conduct international commercial air transport operations (ICAO Annex 6, Part I, Chapter 2).	x	x				
LO	State that Part III shall be applicable to all helicopters engaged in international commercial air transport operations or in international general aviation operations, except it is not applicable to helicopters engaged in aerial work (ICAO Annex 6, Part III, Section 1, Chapter 2).			x	x	x	
071 01 01 03	**General**						
LO	State compliance with laws, regulations and procedures (ICAO Annex 6, Part I, Chapter 3.1/Part III, Section 2, Chapter 1.1).	x	x	x	x	x	
LO	State accident prevention and flight safety programme (ICAO Annex 6, Part I, Chapter 3.2).	x	x				
LO	State flight safety documents system (ICAO Annex 6, Part I, Chapter 3.3).	x	x				
LO	State maintenance release (ICAO Annex 6, Part I, Chapter 8.8/Part III, Section 2, Chapter 6.7).	x	x	x	x	x	

LO	List and describe the lights to be displayed by aircraft (ICAO Annex 6, Part I, Appendix 1).	x	x				
071 01 02 00	**Operational requirements**						
071 01 02 01	**Applicability**						
LO	State the operational regulations applicable to commercial air transportation.	x	x	x	x	x	
LO	Nature of operations and exceptions.	x	x	x	x	x	
071 01 02 02	**General**						
LO	State that a commercial air transportation flight must meet the applicable operational requirements.	x	x	x	x	x	
LO	Flight Manual limitations — Flight through the Height Velocity (HV) envelope.			x	x	x	
LO	Define 'Helicopter Emergency Medical Service'.			x	x	x	
LO	Operations over a hostile environment — Applicability.			x	x	x	
LO	Local area operations — Approval.			x	x	x	
LO	State the requirements about language used for crew communication and operations manual.	x	x	x	x	x	
LO	Explain the relation between MMEL and MEL.	x	x	x	x	x	
LO	State the operator's requirements regarding a management system.	x	x	x	x	x	
LO	State the operator's requirements regarding accident prevention and flight safety programme.	x	x	x	x	x	
LO	State the operator's responsibility regarding the distinction between cabin crew members and additional crew members.	x	x				
LO	State the operations limitations regarding ditching requirements.	x	x				
LO	State the regulations concerning the carriage of persons on an aircraft.	x	x	x	x	x	
LO	State the crew members' responsibilities in the execution of their duties, and define the commander's authority.	x	x	x	x	x	
LO	State the operator's and commander's responsibilities regarding admission to the flight deck and carriage of unauthorised persons or cargo.	x	x	x	x	x	
LO	State the operator's responsibility concerning portable electronic devices.	x	x	x	x	x	

LO	State the operator's responsibilities regarding admission in an aircraft of a person under the influence of drug or alcohol.	x	x	x	x	x	
LO	State the regulations concerning endangering safety.	x	x	x	x	x	
LO	List the documents to be carried on each flight.	x	x	x	x	x	
LO	State the operator's responsibility regarding manuals to be carried.	x	x	x	x	x	
LO	List the additional information and forms to be carried on board.	x	x	x	x	x	
LO	List the items of information to be retained on the ground by the operator.	x	x	x	x	x	
LO	State the operator's responsibility regarding inspections.	x	x	x	x	x	
LO	State the responsibility of the operator and of the commander regarding the production of and access to records and documents.	x	x	x	x	x	
LO	State the operator's responsibility regarding the preservation of documentation and recordings, including recorders recordings.	x	x	x	x	x	
LO	Define the terms used in leasing and state the responsibility and requirements of each party in various cases.	x	x	x	x	x	
071 01 02 03	**Operator certification and supervision**						
LO	State the requirement to be satisfied for the issue of an Air Operator's Certificate (AOC).	x	x	x	x	x	
LO	State the rules applicable to air operator certification.	x	x	x	x	x	
LO	State the conditions to be met for the issue or revalidation of an AOC.	x	x	x	x	x	
LO	Explain the contents and conditions of the AOC.	x	x	x	x	x	
071 01 02 04	**Operational procedures (except long-range flight preparation)**						
LO	Define the terms used for operational procedures.	x	x				
LO	State the operator's responsibilities regarding Operations Manual.	x	x	x	x	x	
LO	State the operator's responsibilities regarding competence of operations personnel.	x	x	x	x	x	
LO	State the operator's responsibilities regarding establishment of procedures.	x	x	x	x	x	

LO	State the operator's responsibilities regarding use of air traffic services.	x	x	x	x	x	
LO	State the operator's responsibilities regarding authorisation of aerodromes/ heliports by the operator.	x	x	x	x	x	
LO	Explain which elements must be considered by the operator when specifying aerodrome/heliport operating minima.	x	x	x	x	x	
LO	State the operator's responsibilities regarding departure and approach procedures.	x	x	x	x	x	
LO	State the parameters to be considered in noise-abatement procedures.	x	x				
LO	State the elements to be considered regarding routes and areas of operation.	x	x	x	x	x	
LO	State the additional specific navigation-performance requirements.	x	x	x	x	x	
LO	State the maximum distance from an adequate aerodrome for two-engine aeroplanes without an ETOPS approval.	x	x				
LO	State the requirement for alternate-airport accessibility check for ETOPS operations.	x	x				
LO	List the factors to be considered when establishing minimum flight altitude.	x	x	x	x	x	
LO	Describe the components of the fuel policy.	x	x	x	x	x	
LO	State the requirements for carrying persons with reduced mobility.	x	x	x	x	x	
LO	State the operator's responsibilities for the carriage of inadmissible passengers, deportees or persons in custody.	x	x	x	x	x	
LO	State the requirements for the stowage of baggage and cargo in the passenger cabin.	x	x	x	x	x	
LO	State the requirements regarding passenger seating and emergency evacuation.	x	x	x	x	x	
LO	Detail the procedures for a passenger briefing in respect of emergency equipment and exits.	x	x	x	x	x	
LO	State the flight preparation forms to be completed before flight.	x	x	x	x	x	
LO	State the commander's responsibilities during flight preparation.	x	x	x	x	x	

LO	State the rules for aerodromes/heliports selection (including ETOPS configuration).	x	x	x	x	x	
LO	Explain the planning minima for IFR flights.	x		x			
LO	State the rules for refuelling/defuelling.	x	x	x	x	x	
LO	State 'crew members at station' policy.	x	x	x	x	x	
LO	State the use of seats, safety belts and harnesses.	x	x	x	x	x	
LO	State securing of passenger cabin and galley requirements.	x	x	x	x	x	
LO	State the commander's responsibility regarding smoking on board.	x	x	x	x	x	
LO	State under which conditions a commander can commence or continue a flight regarding meteorological conditions.	x	x	x	x	x	
LO	State the commander's responsibility regarding ice and other contaminants.	x	x	x	x	x	
LO	State the commander's responsibility regarding fuel to be carried and in-flight fuel management.	x	x	x	x	x	
LO	State the requirements regarding the use of supplemental oxygen.	x	x	x	x	x	
LO	State the ground-proximity detection reactions.	x	x	x	x	x	
LO	Explain the requirements for use of ACAS.	x	x	x	x	x	
LO	State the commander's responsibility regarding approach and landing.	x	x	x	x	x	
LO	State the circumstances under which a report shall be submitted.	x	x	x	x	x	
071 01 02 05	**All-weather operations**						
LO	State the operator's responsibility regarding aerodrome/heliport operating minima.	x		x			
LO	List the parameters to be considered in establishing the aerodrome operating minima.	x		x			
LO	Define the criteria to be taken into consideration for the classification of aeroplanes.	x					
LO	Define the following terms: 'circling', 'low-visibility procedures', 'low-visibility take-off', 'visual approach'.	x		x			

LO	Define the following terms: 'flight control system', 'fail-passive flight control system', 'fail-operational flight control system', 'fail-operational hybrid landing system'.	x					
LO	Define the following terms: 'final approach and take-off area'.			x			
LO	State the general operating rules for low-visibility operations.	x		x			
LO	Low-visibility operations — aerodrome/ heliport considerations.	x		x			
LO	State the training and qualification requirements for flight crew to conduct low-visibility operations.	x		x			
LO	State the operating procedures for low-visibility operations.	x		x			
LO	State the operator's and commander's responsibilities regarding minimum equipment for low-visibility operations.	x		x			
LO	VFR operating minima.	x		x			
LO	Aerodrome operating minima: state under which conditions the commander can commence take-off.	x		x			
LO	Aerodrome operating minima: state that take-off minima are expressed as visibility or RVR.	x		x			
LO	Aerodrome operating minima: state the take-off RVR value depending on the facilities.	x		x			
LO	Aerodrome operating minima: state the system minima for non-precision approach.	x		x			
LO	Aerodrome operating minima: state under which conditions a pilot can continue the approach below MDA/H or DA/H.	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 1 (including single-pilot operations).	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 2 operations.	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 3 operations.	x					
LO	Aerodrome operating minima: state the lowest minima for circling and visual approach.	x		x			

LO	Aerodrome operating minima: state the RVR value and cloud ceiling depending on the facilities (class 1, 2 and 3).			x			
LO	Aerodrome operating minima: state under which conditions an airborne radar approach can be performed and state the relevant minima.			x			
071 01 02 06	**Instruments and equipment**						
LO	State which items do not require an equipment approval.	x	x	x	x	x	
LO	State the requirements regarding spare-fuses availability.	x	x				
LO	State the requirements regarding operating lights.	x	x	x	x	x	
LO	State the requirements regarding windshield wipers.	x	x				
LO	List the equipment for operations requiring a radio communication.			x	x	x	
LO	List the equipment for operations requiring a radio-navigation system.			x	x	x	
LO	List the minimum equipment required for day and night VFR flights.	x	x	x	x	x	
LO	List the minimum equipment required for IFR flights.	x		x			
LO	State the required equipment for single-pilot operation under IFR.	x		x			
LO	State the requirements for an altitude alert system.	x	x				
LO	State the requirements for radio altimeters.			x	x	x	
LO	State the requirements for GPWS/TAWS.	x	x				
LO	State the requirements for ACAS.	x	x				
LO	State the conditions under which an aircraft must be fitted with a weather radar.	x	x	x	x	x	
LO	State the requirements for operations in icing conditions.	x	x	x	x	x	
LO	State the conditions under which a crew member interphone system and public address system are mandatory.	x	x	x	x	x	
LO	State the circumstances under which a cockpit voice recorder is compulsory.	x	x	x	x	x	
LO	State the rules regarding the location, construction, installation and operation of cockpit voice recorders.	x	x	x	x	x	

LO	State the circumstances under which a flight data recorder is compulsory.	x	x	x	x	x	
LO	State the rules regarding the location, construction, installation and operation of flight data recorders.	x	x	x	x	x	
LO	State the requirements about seats, seat safety belts, harnesses and child-restraint devices.	x	x	x	x	x	
LO	State the requirements about 'Fasten seat belt' and 'No smoking' signs.	x	x	x	x	x	
LO	State the requirements regarding internal doors and curtains.	x	x				
LO	State the requirements regarding first-aid kits.	x	x	x	x	x	
LO	State the requirements regarding emergency medical kits and first-aid oxygen.	x	x				
LO	Detail the rules regarding the carriage and use of supplemental oxygen for passengers and crew.	x	x	x	x	x	
LO	Detail the rules regarding crew-protective breathing equipment.	x	x				
LO	Describe the minimum number, type and location of handheld fire extinguishers.	x	x	x	x	x	
LO	Describe the minimum number and location of crash axes and crowbars.	x	x				
LO	Specify the colours and markings used to indicate break-in points.	x	x	x	x	x	
LO	State the requirements for means of emergency evacuation.	x	x				
LO	State the requirements for megaphones.	x	x	x	x	x	
LO	State the requirements for emergency lighting.	x	x	x	x	x	
LO	State the requirements for an emergency locator transmitter.	x	x	x	x	x	
LO	State the requirements for life jackets, life rafts, survival kits and ELTs.	x	x	x	x	x	
LO	State the requirements for crew survival suit.			x	x	x	
LO	State the requirements for survival equipment.	x	x	x	x	x	
LO	State the additional requirements for helicopters operating to or from helidecks located in a hostile sea area.			x	x	x	
LO	State the requirements for an emergency flotation equipment.			x	x	x	

071 01 02 07	**Communication and navigation equipment**						
LO	Explain the general requirements for communication and navigation equipment.	x	x	x	x	x	
LO	State that the radio-communication equipment must provide communications on 121.5 MHz.	x	x	x	x	x	
LO	State the requirements regarding the provision of an audio selector panel.	x	x	x	x	x	
LO	List the requirements for radio equipment when flying under VFR by reference to visual landmarks.	x	x	x	x	x	
LO	List the requirements for communications and navigation equipment when operating under IFR or under VFR over routes not navigated by reference to visual landmarks.	x	x	x	x	x	
LO	State the equipment required to operate within RVSM airspace.	x	x				
071 01 02 09	**Flight crew**						
LO	State the requirement regarding crew composition and in-flight relief.	x	x	x	x	x	
LO	State the requirement for conversion training and checking.	x	x	x	x	x	
LO	State the requirement for differences training and familiarisation training.	x	x	x	x	x	
LO	State the conditions for upgrade from co-pilot to commander.	x	x	x	x	x	
LO	State the minimum qualification requirements to operate as a commander.	x	x	x	x	x	
LO	State the requirement for recurrent training and checking.	x	x	x	x	x	
LO	State the requirement for a pilot to operate on either pilot’s seat.	x	x	x	x	x	
LO	State the minimum recent experience for the commander and the co-pilot.	x	x	x	x	x	
LO	Specify the route and aerodrome/ heliport qualification required for a commander or a pilot flying.	x	x	x	x	x	
LO	State the requirement to operate on more than one type or variant.	x	x	x	x	x	
LO	State that when a flight crew member operates both helicopters and aeroplanes, the operations are limited to one type of each.	x	x				

LO	State the training records requirement.	x	x	x	x	x	
071 01 02 10	**Cabin crew/crew members other than flight crew**						
LO	State who is regarded as a cabin crew member.	x	x	x	x	x	
LO	Detail the requirements regarding cabin crew members.	x	x	x	x	x	
LO	State the acceptability criteria.	x	x	x	x	x	
LO	State the requirements regarding senior cabin crew members.	x	x	x	x	x	
LO	State the conditions to operate on more than one type or variant.	x	x	x	x	x	
071 01 02 11	**Manuals, logs and records**						
LO	Explain the general rules for the operations manual.	x	x	x	x	x	
LO	Explain the structure and subject headings of the operations manual.	x	x	x	x	x	
LO	State the requirements for a journey logbook.	x	x	x	x	x	
LO	Describe the requirements regarding the operational flight plan.	x	x	x	x	x	
LO	State the requirements for document-storage periods.	x	x	x	x	x	
071 01 02 12	**Flight and duty-time limitations and rest requirements**						
LO	Explain the definitions used for flight-time regulation.	x	x				
LO	State the flight and duty limitations.	x	x				
LO	State the requirements regarding the maximum daily flight-duty period.	x	x				
LO	State the requirements regarding rest periods.	x	x				
LO	Explain the possible extension of flight-duty period due to in-flight rest.	x	x				
LO	Explain the captain’s discretion in case of unforeseen circumstances in actual flight operations.	x	x				
LO	Explain the regulation regarding standby.	x	X				
LO	**State the requirements regarding flight-duty, duty and rest-period records.**	x	x				
071 01 02 13	**Transport of dangerous goods by air**						

LO	Explain the terminology relevant to dangerous goods.	x	x	x	x	X	
LO	Explain the scope of the regulation.	x	x	x	x	x	
LO	Explain the limitations on the transport of dangerous goods.	x	x	x	x	x	
LO	State the requirements for the acceptance of dangerous goods.	x	x	x	x	x	
LO	State the requirements regarding inspection for damage, leakage or contamination.	x	x	x	x	x	
LO	Explain the loading restrictions.	x	x	x	x	x	
LO	State the requirement for provision of information to the crew.	x	x	x	x	x	
LO	Explain the requirements for dangerous goods incident and accident reports.	x	x	x	x	x	
071 01 03 00	**Long-range flights**						
071 01 03 01	**Flight management**						
LO	Navigation-planning procedures: describe the operator's responsibilities concerning ETOPS routes; list the factors to be considered by the commander before commencing the flight.	x					
LO	Selection of a route: describe the meaning of the term 'adequate aerodrome'; describe the limitations on extended-range operations with two-engine aeroplanes with and without ETOPS approval.	x					
LO	Selection of cruising altitude (MNPSA Manual Chapter 4): specify the appropriate cruising levels for normal long-range IFR flights and for those operating on the North Atlantic Operational Track Structure.	x					

LO	Selection of alternate aerodrome: state the circumstances in which a take-off alternate must be selected; state the maximum flight distance of a take-off alternate for: two-engine aeroplane, ETOPS-approved aeroplane, three or four-engine aeroplane; state the factors to be considered in the selection of a take-off alternate; state when a destination alternate need not be selected; state when two destination alternates must be selected; state the factors to be considered in the selection of a destination alternate aerodrome; state the factors to be considered in the selection of an en route alternate aerodrome.	x					
LO	Minimum time routes: define, construct and interpret minimum time route (route giving the shortest flight time from departure to destination adhering to all ATC and airspace restrictions).	x					
071 01 03 02	**Transoceanic and polar flight**						

LO	(ICAO Doc 7030) Describe the possible indications of navigation-system degradation. Describe by what emergency means course and INS can be cross-checked in the case of: three navigation systems, two navigation systems. Interpret VOR, NDB, VOR/DME information to calculate aircraft position and aircraft course. Describe the general ICAO procedures applicable in North Atlantic airspace (NAT) if the aircraft is unable to continue the flight in accordance with its air traffic control clearance. Describe the ICAO procedures applicable in North Atlantic Airspace (NAT) in case of radio-communication failure. Describe the recommended initial action if an aircraft is unable to obtain a revised air traffic control clearance. Describe the subsequent action for: aircraft able to maintain assigned flight level, and aircraft unable to maintain assigned flight level. Describe determination of tracks and courses for random routes in NAT. Specify the method by which planned tracks are defined (by latitude and longitude) in the NAT region: when operating predominately in an east–west direction south of 70°N, when operating predominately in an east–west direction north of 70°N. State the maximum flight time recommended between significant points. Specify the method by which planned tracks are defined for flights operating predominantly in a north–south direction. Describe how the desired route must be specified in the air traffic control flight plan.	x					

LO	Polar navigation Terrestrial magnetism characteristics in polar zones Explain why magnetic compasses become unreliable or useless in polar zones. State in which area VORs are referenced to the true north. Specific problems of polar navigation Describe the general problems of polar navigation. Describe what precautions can be taken when operating in the area of compass unreliability as a contingency against INS failure. Describe how grid navigation can be used in conjunction with a Directional Gyro (DG) in polar areas. Use polar stereographic chart and grid coordinates to solve polar navigation problems. Use polar stereographic chart and grid coordinates to calculate navigation data. Use INS information to solve polar navigation problems. Define, calculate: transport precession, Earth-rate (astronomic) precession, convergence factor. Describe the effect of using a free gyro to follow a given course. Describe the effect of using a gyro compass with hourly rate corrector unit to follow a given course. Convert grid navigation data into true navigation data, into magnetic navigation data, and into compass navigation data. Justify the selection of a different 'north' reference at a given position. Calculate the effects of gyro drift due to the Earth's rotation (15 degrees / h × sin Lm).	x					
071 01 03 03	**MNPS airspace**						
LO	Geographical limits: state the lateral dimensions (in general terms) and vertical limits of MNPS airspace (ICAO Doc 7030 NAT/RAC-2 3.2.1); state that operators must ensure that crew follow NAT MNPSA Operations Manual procedures (ICAO Doc 7030 NAT/RAC-2 3.2.3).	x					
LO	Define the following acronyms: MNPS, MNPSA, OCA, OTS, PRM, PTS, RVSM, LRNS, MASPS, SLOP, WATRS (MNPSA Manual, Glossary of Terms).	x					

LO	Aircraft system requirements (MNPSA Manual, Chapter 1): navigation requirements for unrestricted MNPS airspace operations; routes for use by aircraft not equipped with two LRNSs: routes for aircraft with only one LRNS, routes for aircraft with short-range navigation equipment only; performance monitoring.	x					
LO	Organised Track System (MNPSA Manual, Chapter 2): construction of the Organised Track System (OTS); NAT track message; OTS changeover periods.	x					
LO	Other routes and route structures within or adjacent to NAT MNPS airspace (MNPSA Manual, Chapter 3): other routes within NAT MNPS airspace; route structures adjacent to NAT MNPS airspace: North American routes (NARs), Canadian domestic track systems, routes between North America and the Caribbean area.	x					
LO	Flight planning (MNPSA Manual, Chapter 4): all flights should plan to operate on great-circle tracks joining successive significant waypoints; during the hours of validity of the OTS, operators are encouraged to flight plan as follows: in accordance with the OTS or along a route to join or leave an outer track of the OTS or on a random route to remain clear of the OTS; flight levels available on OTS tracks during OTS periods; flight levels on random tracks or outside OTS periods (appropriate direction levels).	x					

LO	Oceanic ATC Clearances (MNPSA Manual, Chapter 5): it is recommended that pilots should request their Oceanic Clearance at least 40 minutes prior to the oceanic entry point ETA; pilots should notify the Oceanic Area control Centre (OAC) of the maximum acceptable flight level possible at the boundary; at some airports, which are situated close to oceanic boundaries, the Oceanic Clearance must be obtained before departure; if an aircraft, which would normally be RVSM and/or MNPS approved, encounters, whilst en route to the NAT Oceanic Airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the MEL requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting Oceanic Clearance; After obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by 3 minutes or more, should pass a revised estimate to ATC; the pilot should pay particular attention when the issued clearance differs from the flight plan, as a significant proportion of navigation errors investigated in the NAT involve an aircraft which has followed its flight plan rather than its differing clearance; if the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic re-clearance; there are three elements to an Oceanic Clearance: route, Mach number and flight level. These elements serve to provide for the three basic elements of separation: lateral, longitudinal and vertical.	x					

LO	Communications and position-reporting procedures (MNPSA Manual, Chapter 6) HF voice communications Pilots communicate with OACs via aeradio stations staffed by communicators who have no executive ATC authority. Messages are relayed, from the ground station to the air traffic controllers in the relevant OAC for action. Frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during daytime. When initiating contact with an aeradio station, the pilot should state the HF frequency in use. SATCOM voice communications Since oceanic traffic typically communicates with ATC through aeradio facilities, a SATCOM call made due to unforeseen inability to communicate by other means should be made to such a facility rather than the ATC centre, unless the urgency of the communication dictates otherwise. An air-to-air VHF frequency has been established for worldwide use when aircraft are out of range of VHF ground stations which utilise the same or adjacent frequencies. This frequency (123.45 MHz) is intended for pilot-to-pilot exchanges of operationally significant information. Standard position report message type. Some aircraft flying in the NAT are required to report MET observations of wind speed and direction plus outside-air temperature. Any turbulence encountered should be included in these reports. General guidance for aircraft operating in, or proposing to operate in, the NAT region, which experience a communications failure: general provisions, onboard HF equipment failure, poor HF propagation conditions, loss of HF communications prior to entry into the NAT, loss of HF communications after entering the NAT. All turbine-engine aeroplanes having a maximum certified take-off mass exceeding 5 700 kg or authorised to carry more than 19 passengers are required to carry and operate ACAS II in the NAT region.	x					

LO	Application of Mach number technique (MNPSA Manual, Chapter 7): practical experience has shown that when two or more turbojet aircraft, operating along the same route at the same flight level, maintain the same Mach number, they are more likely to maintain a constant time interval between each other than when using other methods; pilots must ensure that any required corrections to the indicated Mach number are taken into account when complying with the true Mach number specified in the ATC clearance; after leaving oceanic airspace, pilots must maintain their assigned Mach number in domestic controlled airspace unless and until the appropriate ATC unit authorises a change.	x						
LO	MNPS flight operation & navigation procedures (MNPSA Manual, Chapter 8): the pre-flight procedures for any NAT MNPS flight must include a UTC time check and resynchronisation of the aircraft master clock; state the use of the Master Document; state the requirements for position plotting; PRE-FLIGHT PROCEDURES: alignment of IRS, Satellite Navigation Availability Prediction Programme for flights using GNSS LRNS, loading of initial waypoints, flight plan check; IN-FLIGHT PROCEDURES: ATC Oceanic Clearance, entering the MNPS airspace and reaching an oceanic waypoint, routine monitoring; Strategic Lateral Offset Procedure (SLOP): state that along a route or track there will be three positions that an aircraft may fly: centre line or one or two miles right.	x						
LO	RVSM flight in MNPS airspace (MNPSA Manual, Chapter 9): state the altimeter cross-check to be performed before MNPS airspace entry; state the altimeter cross-check to be performed into the MNPS airspace; in NAT MNPS airspace, pilots always have to report to ATC immediately on reaching any new cruising level; crews should report when a 300 ft or more deviation occurs.	x						

LO	Navigation system degradation or failure (MNPSA Manual, Chapter 10) For this part, consider aircraft equipped with only two operational LRNSs. State the requirements for the following situations: one system fails before take-off; one system fails before the OCA boundary is reached; one system fails after the OCA boundary is crossed; the remaining system fails after entering MNPS airspace.	x					
LO	Special procedures for in-flight contingencies (MNPSA Manual, Chapter 11) General Until a revised clearance is obtained, the specified NAT in-flight contingency procedures should be carefully followed. The general concept of these NAT in-flight contingency procedures is, whenever operationally feasible, to offset from the assigned route by 15 NM and climb or descend to a level which differs from those normally used by 500 ft if below FL410 or by 1 000 ft if above FL410. State the factors which may affect the direction of turn: direction to an alternate airport, terrain clearance, levels allocated on adjacent routes or tracks and any known SLOP offsets adopted by other nearby traffic. Deviations around severe weather State that if the deviation is to be greater than 10 NM, the assigned flight level must be changed by ± 300 ft depending on the followed track and the direction of the deviation (Table 1).	x					
071 01 03 04	**ETOPS**						
LO	State that ETOPS approval is part of an AOC.	x					
LO	State that prior to conducting an ETOPS flight, an operator shall ensure that a suitable ETOPS en route alternate is available, within either the approved diversion time or a diversion time based on the MEL-generated serviceability status of the aeroplane, whichever is shorter.	x					
LO	State the requirements for take-off alternate.	x					
LO	State the planning minima for ETOPS en route alternate.	x					
071 02 00 00	**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS (GENERAL ASPECTS)**						
071 02 01 00	**Operations Manual**						

071 02 01 01	**Operating procedures**						
LO	State that all non-type-related operational policies, instructions and procedures needed for a safe operation are included in Part A of the Operations Manual.	x	x	x	x	x	
LO	State that the following items are included into Part A: de-icing and anti-icing on the ground, adverse and potentially hazardous atmospheric conditions, wake turbulence, incapacitation of crew members, use of the minimum equipment and configuration deviation list(s), security, handling of accidents and occurrences.	x	x	x	x	x	
LO	State that the following items are included into Part A: altitude alerting system procedures, ground proximity warning system procedures, policy and procedures for the use of TCAS/ACAS.	x	x				
LO	State that the following items are included into Part A: rotor downwash.			x	x	x	
LO	Define the following terms: 'commencement of flight', 'inoperative', 'MEL', 'MMEL', rectification interval.	x	x	x	x	x	
LO	Define the 'limits of MEL applicability'.	x	x	x	x	x	
LO	Identify the responsibilities of the operator and the authority with regard to MEL and MMEL.	x	x	x	x	x	
LO	State the responsibilities of the crew members with regard to MEL.	x	x	x	x	x	
LO	State the responsibilities of the commander with regard to MEL.	x	x	x	x	x	
071 02 01 02	**Aeroplane/helicopter operating matters — type-related**						
LO	State that all type-related instructions and procedures needed for a safe operation are included in Part B of the Operations Manual. They will take account of any differences between types, variants or individual aircraft used by the operator.	x	x	x	x	x	
LO	State that the following items are included into Part B: abnormal and emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures.	x	x				
LO	State that the following items are included into Part B: emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures.			x	x	x	
071 02 02 00	**Icing conditions**						
071 02 02 01	**On ground de-icing/anti-icing procedures, types of de-icing/anti-icing fluids**						

LO	Define the following terms: 'anti-icing', 'de-icing', 'one-step de-icing/anti-icing', 'two-step de-icing/anti-icing', 'holdover time'. (ICAO Doc 9640 Glossary)	x	x				
LO	Define the following weather conditions: 'drizzle', 'fog', 'freezing fog', 'freezing drizzle', 'freezing rain', 'frost', 'rain', 'rime', 'slush', 'snow', 'dry snow', 'wet snow'. (ICAO Doc 9640 Glossary)	x	x	x	x	x	
LO	Describe 'The clean aircraft concept' as presented in the relevant chapter of ICAO Doc 9640. (ICAO Doc 9640, Chapter 2)	x	x				
LO	List the types of de-icing/anti-icing fluids available. (ICAO Doc 9640, Chapter 4)	x	x	x	x	x	
LO	State the procedure to be followed when an aeroplane has exceeded the holdover time. (ICAO Doc 9640, Chapter 4)	x	x				
LO	Interpret the fluid holdover time tables and list the factors which can reduce the fluid protection time. (ICAO Doc 9640, Chapter 5 + Attachment tables)	x	x				
LO	State that the pre-take-off check, which is the responsibility of the pilot-in-command, ensures that the critical surfaces of the aeroplane are free of ice, snow, slush or frost just prior to take-off. This check shall be accomplished as close to the time of take-off as possible and is normally made from within the aeroplane by visually checking the wings. (ICAO Doc 9640, Chapter 6)	x	x				
LO	State that an aircraft has to be treated symmetrically. (ICAO Doc 9640, Chapter 11)	x	x				
LO	State that an operator shall establish procedures to be followed when ground de-icing and anti-icing and related inspections of the aeroplane(s) are necessary.	x	x	x	x	x	
LO	State that a commander shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect the performance and/or controllability of the aircraft except as permitted in the Flight Manual.	x	x	x	x	x	
071 02 02 02	**Procedure to apply in case of performance deterioration, on ground/in flight**						
LO	State that the effects of icing are wide-ranging, unpredictable and dependent upon individual aeroplane design. The magnitude of these effects is dependent upon many variables, but the effects can be both significant and dangerous. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	

LO	State that in icing conditions, for a given speed and a given angle of attack, wing lift can be reduced by as much as 30 % and drag increased by up to 40 %. State that these changes in lift and drag will significantly increase stall speed, reduce controllability and alter flight characteristics. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice on critical surfaces and on the airframe may also break away during take-off and be ingested into engines, possibly damaging fan and compressor blades. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice forming on pitot tubes and static ports or on angle-of-attack vanes may give false altitude, airspeed, angle-of-attack and engine-power information for air-data systems. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice, frost and snow formed on the critical surfaces on the ground can have a totally different effect on aircraft flight characteristics than ice formed in flight. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that flight in known icing conditions is subject to limitations found in Part B of the Operations Manual.	x	x	x	x	x	
LO	State where procedures and performances regarding flight in expected or actual icing conditions are located.	x	x	x	x	x	
071 02 03 00	**Bird-strike risk and avoidance**						
LO	State that presence of birds constituting a potential hazard to aircraft operations is part of the pre-flight information. (ICAO Annex 15, Chapter 8)	x	x	x	x	x	
LO	State that information concerning the presence of birds observed by aircrews is made available to the Aeronautical Information Service for such distribution as the circumstances necessitate. (ICAO Annex 15, Chapter 8)	x	x	x	x	x	
LO	State that AIP ENR 5.6 contains information regarding bird migrations. (ICAO Annex 15, Appendix 1)	x	x	x	x	x	
LO	State significant data regarding bird strikes contained in ICAO Doc 9137. (ICAO Doc 9137, Part 3, 1.1.6)	x	x	x	x	x	
LO	List incompatible land use around airports. (ICAO Doc 9137, Part 3, 10.4)	x	x	x	x	x	
LO	Define the commander's responsibilities regarding the reporting of bird hazards and bird strikes.	x	x	x	x	x	
071 02 04 00	**Noise abatement**						
071 02 04 01	**Noise-abatement procedures**						
LO	Define the operator responsibilities regarding establishment of noise-abatement procedures.	x	x	x	x	x	

LO	State the main purpose of NADP 1 and NADP 2. (ICAO Doc 8168, Volume 1, Part V, 3.1.1)	x	x	x	x	x	
LO	State that the pilot-in-command has the authority to decide not to execute a noise-abatement departure procedure if conditions preclude the safe execution of the procedure. (ICAO Doc 8168, Volume 1, Part V, 3.2.1.3)	x	x	x	x	x	
071 02 04 02	**Influence of the flight procedure (departure, cruise, approach)**						
LO	List the main parameters for NADP 1 and NADP 2 (i.e. speeds, heights, etc.). (ICAO Doc 8168, Volume 1, Part V, Appendix to Chapter 3)	x	x				
LO	State that a runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path for purposes of noise abatement. (ICAO Annex 14, Volume 1, 5.3.7.1/Volume 2, 5.3.4.1)	x	x	x	x	x	
LO	State that detailed information about noise-abatement procedures is to be found in AD 2 and 3 of the AIP. (ICAO Annex 15, Appendix 1)	x	x	x	x	x	
071 02 04 03	**Influence by the pilot (power setting, low drag)**						
LO	List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.2.2)	x	x				
LO	List the adverse operating conditions under which noise-abatement procedures during approach should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.4.4)	x	x				
LO	State the rule regarding the use of reverse thrust on landing. (ICAO Doc 8168, Volume 1, Part V, 3.5)	x	x				
071 02 04 04	**Influence by the pilot (power setting, track of helicopter)**						
LO	List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.2.2)			x	x	x	
071 02 05 00	**Fire and smoke**						
071 02 05 01	**Carburettor fire**						
LO	List the actions to be taken in the event of a carburettor fire.	x	x				
071 02 05 02	**Engine fire**						
LO	List the actions to be taken in the event of an engine fire.	x	x				
071 02 05 03	**Fire in the cabin, cockpit, cargo compartment**						

LO	Identify the different types of extinguishants and the type of fire on which each one may be used.	x	x				
LO	Describe the precautions to be considered in the application of fire extinguishant.	x	x				
LO	Identify the appropriate handheld extinguishers to be used in the cockpit, the passenger cabin and toilets, and in the cargo compartments.	x	x				
071 02 05 04	**Smoke in the cockpit and cabin**						
LO	List the actions to be taken in the event of smoke in the cockpit or in the cabin.	x	x				
071 02 05 05	**Actions in case of overheated brakes**						
LO	Describe the problems and safety precautions following overheated brakes after landing or a rejected take-off.	x	x				
071 02 06 00	**Decompression of pressurised cabin**						
071 02 06 01	**Slow decompression**						
LO	Indicate how to detect a slow decompression or an automatic pressurisation system failure.	x	x				
LO	Describe the actions required following a slow decompression.	x	x				
071 02 06 02	**Rapid and explosive decompression**						
LO	Indicate how to detect a rapid or an explosive decompression.	x	x				
071 02 06 03	**Dangers and action to be taken**						
LO	Describe the actions required following a rapid or explosive decompression.	x	x				
LO	Describe the effects on aircraft occupants of a slow decompression and a rapid or explosive decompression.	x	x				
071 02 07 00	**Wind shear and microburst**						
071 02 07 01	**Effects and recognition during departure and approach**						
LO	Define the meaning of the term ‘low-level windshear’. (ICAO Circular 186, Chapter 1)	x	x	x	x	x	
LO	Define: vertical wind shear, horizontal wind shear, updraft and downdraft wind shear. (ICAO Circular 186, Chapter 2)	x	x	x	x	x	
LO	Identify the meteorological phenomena associated with wind shear. (ICAO Circular 186, Chapter 3)	x	x	x	x	x	
LO	Explain recognition of wind shear. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	

071 02 07 02	**Actions to avoid and actions to take during encounter**						
LO	Describe the effects of and actions required when encountering wind shear, at take-off and approach. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe the precautions to be taken when wind shear is suspected, at take-off and approach. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe the effects of and actions required following entry into a strong downdraft wind shear. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe a microburst and its effects. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
071 02 08 00	**Wake turbulence**						
071 02 08 01	**Cause**						
LO	Define the term 'wake turbulence'. (ICAO Doc 4444, 4.9)	x	x	x	x	x	
LO	Describe tip vortices circulation. (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Explain when vortex generation begins and ends. (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Describe vortex circulation on the ground with and without crosswind. (ICAO Doc 9426, Part II)	x	x	x	x	x	
071 02 08 02	**List of relevant parameters**						
LO	List the three main factors which, when combined, give the strongest vortices (heavy, clean, slow). (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Describe the wind conditions which are worst for wake turbulence near the ground. (ICAO Doc 9426, Part II)	x	x	x	x	x	
071 02 08 03	**Actions to be taken when crossing traffic, during take-off and landing**						
LO	Describe the actions to be taken to avoid wake turbulence, specially separations. (ICAO Doc 4444, 5)	x	x	x	x	x	
071 02 09 00	**Security (unlawful events)**						
071 02 09 01	**ICAO Annex 17**						
LO	Give the following definitions: aircraft security check, screening, security, security-restricted area, unidentified baggage. (ICAO Annex 17, 1)	x	x	x	x	x	
LO	Give the objectives of security. (ICAO Annex 17, 2.1)	x	x	x	x	x	

071 02 09 02	**Use of Secondary Surveillance Radar (SSR)**						
LO	Describe the commander's responsibilities concerning notifying the appropriate ATS unit. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning operation of SSR. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning departing from assigned track and/or cruising level. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning the action required or being requested by an ATS unit to confirm SSR code and ATS interpretation response. (ICAO Annex 17 Attachment)	x	x	x	x	x	
071 02 09 03	**Security**						
LO	State the requirements regarding training programmes.	x	x	x	x	x	
LO	State the requirements regarding reporting acts of unlawful interference.	x	x	x	x	x	
LO	State the requirements regarding aircraft search procedures.	x	x	x	x	x	
071 02 10 00	**Emergency and precautionary landings**						
071 02 10 01	**Definition**						
LO	Define 'ditching', 'precautionary landing', 'emergency landing'.	x	x	x	x	x	
LO	Describe a ditching procedure.	x	x	x	x	x	
LO	Describe a precautionary landing.	x	x	x	x	x	
LO	Explain the factors to be considered when deciding to make a precautionary/emergency landing or ditching.	x	x	x	x	x	
071 02 10 02	**Cause**						
LO	List some reasons that may require a ditching, a precautionary landing or an emergency landing.	x	x	x	x	x	
071 02 10 03	**Passenger information**						
LO	Describe the passenger briefing to be given before conducting a precautionary/emergency landing or ditching (including evacuation).	x	x	x	x	x	
071 02 10 04	**Action after landing**						
LO	Describe the actions and responsibilities of crew members after landing.	x	x	x	x	x	
071 02 10 05	**Evacuation**						

LO	State that the aircraft must be stopped and the engine shut down before launching an emergency evacuation.	x	x	x	x	x	
LO	State that evacuation procedures are to be found in Part B of the Operations Manual.	x	x	x	x	x	
LO	State the CS-25 requirements regarding evacuation procedures. (CS 25.803 + Appendix J)	x	x				
071 02 11 00	**Fuel jettisoning**						
071 02 11 01	**Safety aspects**						
LO	State that an aircraft may need to jettison fuel so as to reduce its landing mass in order to effect a safe landing. (ICAO Doc 4444, 15.5.3)	x	x				
LO	State that when an aircraft operating within controlled airspace needs to jettison fuel, the flight crew shall coordinate with ATC the following: route to be flown which, if possible, should be clear of cities and towns, preferably over water and away from areas where thunderstorms have been reported or are expected; the level to be used, which should be not less than 1 800 m (6 000 ft); and the duration of fuel jettisoning. (ICAO Doc 4444, 15.5.3)	x	x				
LO	State that flaps and slats may adversely affect fuel jettisoning. (CS 25.1001)	x	x				
071 02 11 02	**Requirements**						
LO	State that a fuel-jettisoning system must be installed on each aeroplane unless it is shown that the aeroplane meets some CS-25 climb requirements. (CS 25.1001)	x	x				
LO	State that a fuel-jettisoning system must be capable of jettisoning enough fuel within 15 minutes. (CS 25.1001)	x	x				
071 02 12 00	**Transport of dangerous goods**						
071 02 12 01	**ICAO Annex 18**						
LO	Give the following definitions: dangerous goods, dangerous goods accident, dangerous goods incident, exemption, incompatible, packaging, UN number. (ICAO Annex 18, Chapter 1)	x	x	x	x	x	
LO	State that detailed provisions for dangerous goods transportation are contained in the Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284). (ICAO Annex 18, Chapter 2, 2.2.1)	x	x	x	x	x	
LO	State that in case of an in-flight emergency, the pilot-in-command must inform the ATC of dangerous goods transportation. (ICAO Annex 18, Chapter 9, 9.5)	x	x	x	x	x	
071 02 12 02	**Technical Instructions (ICAO Doc 9284)**						

LO	Explain the principle of compatibility and segregation. (ICAO Doc 9284)	x	x	x	x	x	
LO	Explain the special requirements for the loading of radioactive materials. (ICAO Doc 9284)	x	x	x	x	x	
LO	Explain the use of the dangerous goods list. (ICAO Doc 9284)	x	x	x	x	x	
LO	Identify the labels. (ICAO Doc 9284)	x	x	x	x	x	
071 02 12 03	**Transport of dangerous goods by air**						
LO	State that dangerous goods transportation is subject to operator approval.	x	x	x	x	x	
LO	Identify articles and substances, which would otherwise be classed as dangerous goods, that are excluded from the provisions.	x	x	x	x	x	
LO	State that some articles and substances may be forbidden for air transportation.	x	x	x	x	x	
LO	State that packing must comply with the Technical Instructions specifications.	x	x	x	x	x	
LO	List the labelling and marking requirements.	x	x	x	x	x	
LO	List the Dangerous Goods Transport Document requirements.	x	x	x	x	x	
LO	List the Acceptance of Dangerous Goods requirements.	x	x	x	x	x	
LO	Explain the need for an inspection prior to loading on an aircraft.	x	x	x	x	x	
LO	State that some dangerous goods are designated for carriage only on cargo aircraft.	x	x	x	x	x	
LO	State that accidents or incidents involving dangerous goods are to be reported.	x	x	x	x	x	
LO	State that misdeclared or undeclared dangerous goods found in baggage are to be reported.	x	x	x	x	x	
071 02 13 00	**Contaminated runways**						
071 02 13 01	**Kinds of contamination**						
LO	Define a 'contaminated runway', a 'damp runway', a 'wet runway', and a 'dry runway'.	x	x				
LO	List the different types of contamination: damp, wet or water patches, rime or frost-covered, dry snow, wet snow, slush, ice, compacted or rolled snow, frozen ruts or ridges. (ICAO Annex 15, Appendix 2)	x	x				
LO	Give the definitions of the various types of snow. (ICAO Annex 15, Appendix 2)	x	x				

071 02 13 02	**Estimated surface friction, friction coefficient**						
LO	Identify the difference between friction coefficient and estimated surface friction. (ICAO Annex 15, Appendix 2)	x	x				
LO	State that when friction coefficient is 0.40 or higher, the expected braking action is good. (ICAO Annex 15, Appendix 2)	x	x				
071 02 13 03	**Hydroplaning principles and effects**						
LO	Define the different types of hydroplaning. (NASA TM-85652/Tire friction performance/ pp. 6 to 9)	x	x				
LO	Compute the two dynamic hydroplaning speeds using the following formulas: Spin-down speed (rotating tire) (kt) = 9 square root (pressure in PSI) Spin-up speed (non-rotating tire) (kt) = 7.7 square root (pressure in PSI). (NASA TM-85652/Tire friction performance /p. 8)	x	x				
LO	State that it is the spin-up speed rather than the spin-down speed which represents the actual tire situation for aircraft touchdown on flooded runways. (NASA TM-85652/Tire friction performance/p. 8)	x	x				
071 02 13 04	**Procedures**						
LO	State that some wind limitations may apply in case of contaminated runways. Those limitations are to be found in Part B of the Operations Manual — Limitations.	x	x				
LO	State that the procedures associated with take-off and landing on contaminated runways are to be found in Part B of the Operations Manual — Normal procedures.	x	x				
LO	State that the performances associated with contaminated runways are to be found in Part B of the Operations Manual — Performance.	x	x				
071 02 13 05	**Snowtam**						
LO	Interpret from a snowtam the contamination and braking action on a runway.	x	x				
071 02 14 00	**Rotor downwash**						
071 02 14 01	**Describe downwash**						
LO	Describe the downwash.			x	x	x	
071 02 14 02	**Effects**						

LO	Explain the effects on: soil erosion, water dispersal and spray, recirculation, damage to property, loose articles.			x	x	x	
071 02 15 00	**Operation influence by meteorological conditions (Helicopter)**						
071 02 15 01	**White-out/sand/dust**						
LO	Give the definition of 'white-out'.			x	x	x	
LO	Describe loss of spatial orientation.			x	x	x	
LO	Describe take-off and landing techniques.			x	x	x	
071 02 15 02	**Strong winds**						
LO	Describe blade sailing.			x	x	x	
LO	Describe wind operating envelopes.			x	x	x	
LO	Describe vertical speed problems.			x	x	x	
071 02 15 03	**Mountain environment**						
LO	Describe constraints associated with mountain environment.			x	x	x	
071 03 00 00	**EMERGENCY PROCEDURES (HELICOPTER)**						
071 03 01 00	**Influence of technical problems**						
071 03 01 01	**Engine failure**						
LO	Describe techniques for failure in: hover, climb, cruise, approach.			x	x	x	
071 03 01 02	**Fire in cabin/cockpit/engine**						
LO	Describe the basic actions when encountering fire in the cabin, cockpit or engine.			x	x	x	
071 03 01 03	**Tail/rotor/directional control failure**						
LO	Describe the basic actions following loss of tail rotor.			x	x	x	
LO	Describe the basic actions following loss of directional control.			x	x	x	
071 03 01 04	**Ground resonance**						
LO	Describe recovery actions.			x	x	x	
071 03 01 05	**Blade stall**						
LO	Describe cause and recovery actions when encountering retreating blade stall.			x	x	x	
071 03 01 06	**Settling with power (vortex ring)**						
LO	Describe prerequisite conditions and recovery actions.			x	x	x	

071 03 01 07	**Overpitch**						
LO	Describe recovery actions.			x	x	x	
071 03 01 08	**Overspeed: rotor/engine**						
LO	Describe overspeed control.			x	x	x	
071 03 01 09	**Dynamic rollover**						
LO	Describe potential conditions and recovery action.			x	x	x	
071 03 01 10	**Mast bumping**						
LO	Describe conditions 'conducive to' and 'avoidance of' effect.			x	x	x	

M. SUBJECT 081 — PRINCIPLES OF FLIGHT (AEROPLANE)

(1) The following standard conventions are used for certain mathematical symbols:

* multiplication

≥ greater than or equal to

≤ less than or equal to

SQRT( ) square root of the function, symbol or number in round brackets

(2) Normally, it should be assumed that the effect of a variable under review is the only variation that needs to be addressed, unless specifically stated otherwise.

(3) Candidates are expected in simple calculations to be able to convert knots (kt) into metres/second (m/s), and know the appropriate conversion factors by heart.

(4) In the subsonic range, as covered under subject 081 01, compressibility effects normally are not considered, unless specifically mentioned.

(5) For those questions related to propellers (subject 081 07), as a simplification of the physical reality, the inflow speed into the propeller plane is taken as the aeroplane's TAS. In addition, when discussing propeller rotational direction, it will always be specified as seen from behind the propeller plane.

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
080 00 00 00	**PRINCIPLES OF FLIGHT**						
081 00 00 00	**PRINCIPLES OF FLIGHT — AEROPLANE**						
081 01 00 00	**SUBSONIC AERODYNAMICS**						
081 01 01 00	**Basics, laws and definitions**						
081 01 01 01	**Laws and definitions**						

LO	List the SI units of measurement for mass, acceleration, weight, velocity, density, temperature, pressure, force, wing loading and power. Define 'mass', 'force', 'acceleration' and 'weight'. State and interpret Newton's laws. State and interpret Newton's first law. State and interpret Newton's second law. State and interpret Newton's third law. Explain air density. List the atmospheric properties that effect air density. Explain how temperature and pressure changes affect density. Define 'static pressure'. Define 'dynamic pressure'. Define the 'formula for dynamic pressure'. Apply the formula for a given altitude and speed. State Bernoulli's equation. Define 'total pressure'. Apply the equation to a Venturi. Describe how the IAS is acquired from the pitot-static system. Describe the relationship between density, temperature and pressure for air. Describe the Equation of Continuity. Define 'IAS', 'CAS', 'EAS', 'TAS'.	x	x				
081 01 01 02	**Basics about airflow**						
LO	Describe steady and unsteady airflow. Explain the concept of a streamline. Describe and explain airflow through a stream tube. Explain the difference between two and three-dimensional airflow.	x	x				

081 01 01 03	**Aerodynamic forces and moments on aerofoils**						
LO	Describe the force resulting from the pressure distribution around an aerofoil. Resolve the resultant force into the components 'lift' and 'drag'. Describe the direction of lift and drag. Define the 'aerodynamic moment'. List the factors that affect the aerodynamic moment. Describe the aerodynamic moment for a symmetrical aerofoil. Describe the aerodynamic moment for a positively and negatively cambered aerofoil. Forces and equilibrium of forces (refer to 081 08 00 00). Define 'angle of attack'.	x	x				
081 01 01 04	**Shape of an aerofoil section**						
LO	Describe the following parameters of an aerofoil section: leading edge; trailing edge; chord line; thickness to chord ratio or relative thickness; location of maximum thickness; camber line; camber; nose radius. Describe a symmetrical and an asymmetrical aerofoil section.	x	x				
081 01 01 05	**Wing shape**						
LO	Describe the following parameters of a wing: span; tip and root chord; taper ratio; wing area;	x	x				

	wing planform; mean geometric chord; mean aerodynamic chord (MAC); aspect ratio; dihedral angle; sweep angle; wing twist; geometric; aerodynamic; angle of incidence. Remark: In certain textbooks, angle of incidence is used as angle of attack. For Part-FCL theoretical knowledge examination purposes this use is discontinued and the angle of incidence is defined as the angle between the aeroplane longitudinal axis and the wing-root chord line.						
081 01 02 00	**Two-dimensional airflow around an aerofoil**						
081 01 02 01	**Streamline pattern**						
LO	Describe the streamline pattern around an aerofoil. Describe converging and diverging streamlines and their effect on static pressure and velocity. Describe upwash and downwash.	x	x				
081 01 02 02	**Stagnation point**						
LO	Describe the stagnation point. Explain the effect on the stagnation point of angle-of-attack changes. Explain local-pressure changes.	x	x				
081 01 02 03	**Pressure distribution**						
LO	Describe pressure distribution and local speeds around an aerofoil including effects of camber and angle of attack. Describe where the minimum local static pressure is typically situated on an aerofoil.	x	x				
081 01 02 04	**Centre of pressure and aerodynamic centre**						

LO	Explain centre of pressure and aerodynamic centre.	x	x				
081 01 02 05	**Lift and downwash**						
LO	Explain the association between lift and downwash.	x	x				
081 01 02 06	**Drag and wake**						
LO	List two physical phenomena that cause drag. Describe skin friction drag. Describe pressure (form) drag. Explain why drag and wake cause loss of energy (momentum).	x	x				
081 01 02 07	**Influence of angle of attack**						
LO	Explain the influence of angle of attack on lift.	x	x				
081 01 02 08	**Flow separation at high angles of attack**						
LO	Refer to 081 01 08 01.	x	x				
081 01 02 09	**The lift — α graph**						
LO	Describe the lift and angle-of-attack graph. Explain the significant points on the graph. Describe lift against α graph for a symmetrical aerofoil.	x	x				
081 01 03 00	**Coefficients**						
LO	Explain why coefficients are used in general.	x	x				
081 01 03 01	**The lift coefficient Cl**						
LO	Describe the lift formula and perform simple calculations. Describe the Cl – α graph (symmetrical and positively/ negatively cambered aerofoils). Describe the typical difference in Cl – α graph for fast and slow aerofoil design. Define ‘ClMAX’ and ‘αstall’ on the graph.	x	x				
081 01 03 02	**The drag coefficient Cd**						
LO	Describe the drag formula and perform simple calculations. Discuss the effect of the shape of a body on the drag coefficient.	x	x				

	Describe the Cl – Cd graph (aerofoil polar). Indicate minimum drag on the graph. Explain why the Cl–Cd ratio is important as a measure of performance. State the normal values of Cl–Cd.						
081 01 04 00	**Three-dimensional airflow about an aeroplane**						
LO	Define 'angle of attack.' Remark: For theoretical knowledge examination purposes, the angle-of-attack definition requires a reference line. This reference line for 3-D has been chosen to be the longitudinal axis and for 2-D the chord line. Explain the difference between the angle of attack and the attitude of an aeroplane.	x	x				
081 01 04 01	**Streamline pattern**						
LO	Describe the general streamline pattern around the wing, tail section and fuselage. Explain and describe the causes of spanwise flow over top and bottom surfaces. Describe tip vortices and local α. Explain how tip vortices vary with angle of attack. Explain upwash and downwash due to tip vortices. Describe spanwise lift distribution including the effect of wing planform. Describe the causes, distribution and duration of the wake turbulence behind an aeroplane. Describe the influence of flap deflection on the tip vortex. List the parameters that influence wake turbulence.	x	x				
081 01 04 02	**Induced drag**						
LO	Explain what causes the induced drag. Describe the approximate formula for the induced drag coefficient. State the factors that affect induced drag.	x	x				

	Describe the relationship between induced drag and total drag in the cruise. Describe the effect of mass on induced drag at a given IAS. Describe the means to reduce induced drag: • aspect ratio; • winglets; • tip tanks; • wing twist; • camber change. Describe the influence of lift distribution on induced drag. Describe the influence of tip vortices on the angle of attack. Explain induced and effective local angle of attack. Explain the influence of the induced angle of attack on the direction of the lift vector. Explain the relationship between induced drag and: speed; aspect ratio; wing planform; bank angle in a horizontal coordinated turn. Explain the induced drag coefficient. Explain the relationship between the induced drag coefficient and the angle-of-attack or lift coefficient. Explain the influence of induced drag on: CL–angle-of-attack graph, how the effect on the graph when comparing high and low aspect ratio wings; CL–CD (aeroplane polar), show the effect on the graph when comparing high and low aspect ratio wings; parabolic aeroplane polar in a graph and as a formula (CD = CDp + kCL2).						

081 01 05 00	**Total drag**						
LO	State that total drag consists of parasite drag and induced drag.	x	x				
081 01 05 01	**Parasite drag**						
LO	List the types of drag that are included in parasite drag. Describe form (pressure) drag. Describe interference drag. Describe friction drag.	x	x				
081 01 05 02	**Parasite drag and speed**						
LO	Describe the relationship between parasite drag and speed.	x	x				
081 01 05 03	**Induced drag and speed**						
LO	Refer to 081 01 04 02.	x	x				
081 01 05 04	**Intentionally left blank**						
081 01 05 05	**Total drag and speed**						
LO	Explain the total drag–speed graph and the constituent drag components. Indicate the speed for minimum drag.	x	x				
081 01 05 06	**Intentionally left blank**						
081 01 05 07	**The total drag–speed graph**						
LO	Describe the effect of aeroplane gross mass on the graph. Describe the effect of pressure altitude on: • drag–IAS graph; • drag–TAS graph. Describe speed stability from the graph. Describe non-stable, neutral and stable IAS regions. Explain what happens to the IAS and drag in the non-stable region if speed suddenly decreases.	x	x				
081 01 06 00	**Ground effect**						
LO	Explain what happens to the tip vortices, downwash, airflow pattern, lift and drag in ground effect.	x	x				

081 01 06 01	**Effect on CDi**						
LO	Describe the influence of ground effect on CDi and induced angle of attack. Explain the effects on entering and leaving ground effect.	x	x				
081 01 06 02	**Effect on αstall**						
LO	Describe the influence of ground effect on αstall.	x	x				
081 01 06 03	**Effect on CL**						
LO	Describe the influence of ground effect on CL.	x	x				
081 01 06 04	**Effect on take-off and landing characteristics of an aeroplane**						
LO	Describe the influence of ground effect on take-off and landing characteristics and performance of an aeroplane. Describe the difference between: high and low wing characteristics; high and low tail characteristics. Explain the effects on static pressure measurements at the static ports when entering and leaving ground effect.	x	x				
081 01 07 00	**The relationship between lift coefficient and speed in steady, straight and level flight**						
081 01 07 01	**Represented by an equation**						
LO	Explain the effect on CL during speed increase/decrease in steady, straight and level flight, and perform simple calculations.	x	x				
081 01 07 02	**Represented by a graph**						
LO	Explain, by using a graph, the effect on speed of CL changes at a given weight.	x	x				
081 01 08 00	**The stall**						
081 01 08 01	**Flow separation at increasing angles of attack**						
LO	Define the ‘boundary layer’. Describe the thickness of a typical boundary layer. List the factors that affect thickness. Describe the laminar layer.	x	x				

	Describe the turbulent layer. Define the 'transition point'. List the differences between laminar and turbulent boundary layers. Explain why the laminar boundary layer separates easier than the turbulent one. List the factors that slow down the airflow over the aft part of an aerofoil, as the angle of attack increases. Define the 'separation point' and describe its location as a function of angle of attack. Define the 'critical stall angle of attack'. Describe the influence of increasing the angle of attack on: the forward stagnation point; the pressure distribution; the location of the centre of pressure (straight and swept back wing); CL and L; CD and D; the pitching moment (straight and swept back wing); the downwash at the horizon stabiliser. Explain what causes the possible natural buffet on the controls in a pre-stall condition. Describe the effectiveness of the flight controls in a pre-stall condition. Describe and explain the normal post-stall behaviour of a wing/ aeroplane; Describe the dangers of using the controls close to the stall.						
081 01 08 02	**The stall speed**						
LO	Explain VS0, VS1, VSR, VS1g. Solve the 1G stall speed from the lift formula. Describe and explain the influence of the following parameters on stall speed: centre of gravity;	x	x				

	thrust component; slipstream; wing loading; mass; wing contamination; angle of sweep; altitude (for compressibility effects, see 081 02 03 02). Define the 'load factor n'. Explain why the load factor increases in a turn. Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre. Describe and explain the influence of the 'load factor n' on stall speed. Explain the expression 'accelerated stall'. Remark: Sometimes accelerated stall is also erroneously referred to as high-speed stall. This latter expression will not be used for subject 081. Calculate the change of stall speed as a function of the load factor. Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle. Calculate the change of stall speed as a function of the gross mass.						
081 01 08 03	**The initial stall in span-wise direction**						
LO	Explain the initial stall sequence on the following platforms: • elliptical; • rectangular; • moderate and high taper; • sweepback or delta. Explain the influence of geometric twist (wash out) and aerodynamic twist. Explain the influence of deflected ailerons.	x	x				

	Explain the influence of fences, vortilons, saw teeth, vortex generators.						
081 01 08 04	**Stall warning**						
LO	Explain why stall warning is necessary. Explain when aerodynamic and artificial stall warnings are used. Explain why CS-23 and CS-25 require a margin to stall speed. Describe: buffet; stall strip; flapper switch (leading-edge stall-warning vane); angle-of-attack vane; angle-of-attack probe; stick shaker. Describe the recovery after: stall warning; stall; stick-pusher actuation.	x	x				
081 01 08 05	**Special phenomena of stall**						
LO	Describe the basic stall requirements for transport category aeroplanes. Explain the difference between power-off and power-on stalls and recovery. Describe stall and recovery in a climbing and descending turn. Describe the effect on stall and recovery characteristics of: wing sweep (consider both forward and backward sweep); T-tailed aeroplane; canards. Describe super-stall or deep-stall. Describe the philosophy behind the stick-pusher system.	x	x				

	Explain the effect of ice, frost or snow on the stagnation point. Explain the absence of stall warning. Explain the abnormal behaviour of the stall. Describe and explain cause and effects of the stabiliser stall (negative tail stall). Describe when to expect in-flight icing. Explain how the effect is changed when retracting/ extending lift augmentation devices. Describe how to recover from a stall after a configuration change caused by in-flight icing. Explain the effect of a contaminated wing. Explain what 'on-ground' icing is. Describe the aerodynamic effects of de-icing/anti-ice fluid after the holdover time has been reached. Describe the aerodynamic effects of heavy tropical rain on stall speed and drag. Explain how to avoid spins. List the factors that cause a spin to develop. Describe spin development, recognition and recovery. Describe the differences in recovery techniques for aeroplanes that have different mass distributions between the wings and the fuselage.						
081 01 09 00	**CLMAX augmentation**						
081 01 09 01	**Trailing-edge flaps and the reasons for use in take-off and landing**						
LO	Describe trailing-edge flaps and the reasons for their use during take-off and landing. Identify the different types of trailing-edge flaps given a relevant diagram: split flaps; plain flaps; slotted flaps; fowler flaps.	x	x				

	Describe their effect on wing geometry. Describe how the wing's effective camber increases. Describe how the effective chord line differs from the normal chord line. Describe their effect on: the location of centre of pressure; pitching moments; stall speed. Compare their influence on the CL–α graph: indicate the variation in CL at any given angle of attack; indicate the variation in CD at any given angle of attack; indicate their effect on CLMAX; indicate their effect on the stall or critical angle of attack; indicate their effect on the angle of attack at a given CL. Compare their influence on the CL–CD graph: indicate how the (CL/CD)MAX differs from that of a clean wing. Explain the influence of trailing-edge flap deflection on the glide angle. Describe flap asymmetry: explain the effect on aeroplane controllability. Describe trailing-edge flap effect on take-off and landing: explain the advantages of lower-nose attitudes; explain why take-off and landing speeds/distances are reduced.						
081 01 09 02	**Leading-edge devices and the reasons for their use in take-off and landing**						
LO	Describe leading-edge high-lift devices. Identify the different types of leading-edge high-lift devices given a relevant diagram:	x	x				

	• Krueger flaps; • variable camber flaps; • slats. State their effect on wing geometry. Describe the function of the slot. Describe how the wing's effective camber increases. Describe how the effective chord line differs from the normal chord line. State their effect on the stall speed, also in comparison with trailing edge flaps. Compare their influence on the CL–α graph, compared with trailing-edge flaps and a clean wing: indicate the effect of leading-edge devices on CLMAX; explain how the CL curve differs from that of a clean wing; indicate the effect of leading-edge devices on the stall or critical angle of attack. Compare their influence on the CL–CD graph; Describe slat asymmetry: describe the effect on aeroplane controllability. Explain the reasons for using leading-edge high-lift devices on take-off and landing: explain the disadvantage of increased nose-up attitudes; explain why take-off and landing speeds/distances are reduced.						
081 01 09 03	**Vortex generators**						
LO	Explain the purpose of vortex generators. Describe their basic operating principle. State their advantages and disadvantages.	x	x				
081 01 10 00	**Means to reduce the CL–CD ratio**						
081 01 10 01	**Spoilers and the reasons for use in the different phases of flight**						

LO	Describe the aerodynamic functioning of spoilers: • roll spoilers; • flight spoilers (speed brakes); • ground spoilers (lift dumpers). Describe the effect of spoilers on the CL–α graph and stall speed. Describe the influence of spoilers on the CL–CD graph and lift–drag ratio.	x	x				
081 01 10 02	**Speed brakes and the reasons for use in the different phases of flight**						
LO	Describe speed brakes and the reasons for use in the different phases of flight. State their influence on the CL–CD graph and lift–drag ratio. Explain how speed brakes increase parasite drag. Describe how speed brakes affect the minimum drag speed. Describe their effect on rate and angle of descent.	x	x				
081 01 11 00	**The boundary layer**						
081 01 11 01	**Different types**						
LO	Refer to 081 01 08 01.	x	x				
081 01 11 02	**Their advantages and disadvantages on pressure drag and friction drag**						
081 01 12 00	**Aerodynamic degradation**						
081 01 12 01	**Ice and other contaminants**						
LO	Describe the locations on an aeroplane where ice build-up will occur during flight. Explain the aerodynamic effects of ice and other contaminants on: lift (maximum lift coefficient); drag; stall speed; stalling angle of attack; stability and controllability.	x	x				

	Explain the aerodynamic effects of icing on the various phases during take-off.						
081 01 12 02	**Deformation and modification of airframe, ageing aeroplanes**						
LO	Describe the effect of airframe deformation and modification of an ageing aeroplane on aeroplane performance. Explain the effect on boundary layer condition of an ageing aeroplane.	x	x				
081 02 00 00	**HIGH-SPEED AERODYNAMICS**						
081 02 01 00	**Speeds**						
081 02 01 01	**Speed of sound**						
LO	Define 'speed of sound'. Explain the variation of the speed of sound with altitude. Describe the influence of temperature on the speed of sound.	x					
081 02 01 02	**Mach number**						
LO	Define 'Mach number as a function of TAS and speed of sound'.	x					
081 02 01 03	**Influence of temperature and altitude on Mach number**						
LO	Explain the absence of change of Mach number with varying temperature at constant flight level and calibrated airspeed. Referring to 081 08 01 02 and 081 08 01 03, explain the relationship of Mach number, TAS and IAS during climb and descent at constant Mach number and IAS, and explain variation of lift coefficient, angle of attack, pitch and flight-path angle. Referring to 081 06 01 04 and 081 06 01 05, explain that VMO can be exceeded during a descent at constant Mach number and that MMO can be exceeded during a climb at constant IAS.	x					
081 02 01 04	**Compressibility**						
LO	State that compressibility means that density can change along a streamline.	x					

	Describe how the streamline pattern changes due to compressibility. State that Mach number is a measure of compressibility.						
081 02 01 05	**Subdivision of aerodynamic flow**						
LO	List the subdivision of aerodynamic flow: subsonic flow; transonic flow; supersonic flow. Describe the characteristics of the flow regimes listed above. State that transport aeroplanes normally cruise at Mach numbers above Mcrit.	x					
081 02 02 00	**Shock waves**						
LO	Define a 'shock wave'.	x					
081 02 02 01	**Normal shock waves**						
LO	Describe a normal shock wave with respect to changes in: static temperature; static and total pressure; velocity; local speed of sound; Mach number; density. Describe a normal shock wave with respect to orientation relative to the wing surface. Explain the influence of increasing Mach number on a normal shock wave, at positive lift, with respect to: strength; length; position relative to the wing; second shock wave at the lower surface. Explain the influence of angle of attack on shock-wave intensity at constant Mach number.	x					

	Discuss the bow wave.						
081 02 02 02	**Oblique shock waves**						
LO	Describe an oblique shock wave with respect to changes in: static temperature; static and total pressure; velocity; local speed of sound; Mach number; density. Compare the characteristics of normal and oblique shock waves.	x					
081 02 02 03	**Mach cone**						
LO	Define 'Mach angle μ' with a formula and perform simple calculations. Identify the Mach-cone zone of influence of a pressure disturbance due to the presence of the aeroplane. Explain 'sonic boom'.	x					
081 02 03 00	**Effects of exceeding Mcrit**						
081 02 03 01	**Mcrit**						
LO	Define 'Mcrit'. Explain how a change in angle of attack influences Mcrit.	x					
081 02 03 02	**Effect on lift**						
LO	Describe the behaviour of lift coefficient CL versus Mach number at constant angle of attack. Explain shock-induced separation, shock stall, and describe its relationship with Mach buffet. Define 'shock stall'. Remark: For theoretical knowledge examination purposes, the following description is used for shock stall: Shock stall occurs when the lift coefficient, as a function of Mach number, reaches its maximum value (for a given angle of attack).	x					

	Describe the consequences of exceeding Mcrit with respect to: gradient of the CL–α graph; CLMAX (stall speed). Explain the change in stall speed (IAS) with altitude. Discuss the effect on critical or stalling angle of attack.						
081 02 03 03	**Effect on drag**						
LO	Describe wave drag. Describe the behaviour of drag coefficient CD versus Mach number at constant angle of attack. Explain the effect of Mach number on the CL–CD graph. Define 'drag divergence Mach number' and explain the relation with Mcrit.	x					
081 02 03 04	**Effect on pitching moment**						
LO	Discuss the effect of Mach number on the location of centre of pressure and aerodynamic centre. Explain 'tuck under' effect. List the methods of compensating for tuck under effect. Discuss the aerodynamic functioning of the Mach trim system. Discuss the corrective measures if the Mach trim fails.	x					
081 02 03 05	**Effect on control effectiveness**						
LO	Discuss the effects on the functioning of control surfaces.	x					
081 02 04 00	**Buffet onset**						
LO	Explain the concept of buffet margin and describe the influence of the following parameters: angle of attack; Mach number; pressure altitude;	x					

	mass; load factor; angle of bank; CG location. Explain how the buffet onset boundary chart can be used to determine manoeuvre capability. Describe the effect of exceeding the speed for buffet onset. Explain aerodynamic ceiling and 'coffin corner'. Explain the concept of the '1.3G' altitude. Find (using an example graph): buffet free range; aerodynamic ceiling at a given mass; load factor and bank angle at which buffet occurs at a given mass, Mach number and pressure altitude.						
081 02 05 00	**Means to influence Mcrit**						
081 02 05 01	**Wing sweep**						
LO	Explain the influence of the angle of sweep on: Mcrit; effective thickness/chord change or velocity component perpendicular to the quarter chord line. Describe the influence of the angle of sweep at subsonic speed on: CLMAX; efficiency of high-lift devices. pitch-up stall behaviour. Discuss the effect of wing sweep on drag.	x					
081 02 05 02	**Aerofoil shape**						
LO	Explain the use of thin aerofoils with reduced camber. Explain the main purpose of supercritical aerofoils.	x					

	Identify the shape characteristics of a supercritical aerofoil shape. Explain the advantages and disadvantages of supercritical aerofoils for wing design.						
081 02 05 03	**Vortex generators**						
LO	Explain the use of vortex generators as a means to avoid or restrict flow separation.	x					
081 02 05 04	**Area ruling**						
LO	Explain area ruling in aeroplane design.	x					
081 03 00 00	**Intentionally left blank**						
081 04 00 00	**STABILITY**						
081 04 01 00	**Static and dynamic stability**						
081 04 01 01	**Basics and definitions**						
LO	Define 'static stability': identify a statically stable, neutral and unstable condition (positive, neutral and negative static stability). Explain manoeuvrability. Explain why static stability is the opposite of manoeuvrability. Define 'dynamic stability': identify a dynamically stable, neutral and unstable motion (positive, neutral and negative dynamic stability); identify periodic and aperiodic motion. Explain what combinations of static and dynamic stability will return an aeroplane to the equilibrium state after a disturbance.	x	x				
081 04 01 02	**Precondition for static stability**						
LO	Explain an equilibrium of forces and moments as the condition for the concept of static stability.	x	x				
081 04 01 03	**Sum of forces**						
LO	Identify the forces considered in the equilibrium of forces.	x	x				
081 04 01 04	**Sum of moments**						

LO	Identify the moments about all three axes considered in the equilibrium of moments. Discuss the effect of sum of moments not being zero.	x	x				
081 04 02 00	**Intentionally left blank**						
081 04 03 00	**Static and dynamic longitudinal stability**						
081 04 03 01	**Methods for achieving balance**						
LO	Explain the stabiliser and the canard as the means to satisfy the condition of nullifying the total sum of the moments about the lateral axis. Explain the influence of the location of the wing centre of pressure relative to the centre of gravity on the magnitude and direction of the balancing force on stabiliser and canard. Explain the influence of the indicated airspeed on the magnitude and direction of the balancing force on stabiliser and canard. Explain the influence of the balancing force on the magnitude of the wing/fuselage lift. Explain the use of the elevator deflection or stabiliser angle for the generation of the balancing force. Explain the elevator deflection required to balance thrust changes.	x	x				
081 04 03 02	**Static longitudinal stability**						
LO	Explain the changes in aerodynamic forces when varying angle of attack for a static longitudinally stable aeroplane. Discuss the effect of CG location on pitch manoeuvrability.	x	x				
081 04 03 03	**Neutral point**						
LO	Define ‘neutral point’. Explain why the location of the neutral point is only dependent on the aerodynamic design of the aeroplane.	x	x				
081 04 03 04	**Factors affecting neutral point**						
LO	Indicate the location of the neutral point relative to the locations of the aerodynamic centre of the wing and tail/canard.	x	x				

	Explain the influence of the downwash variations with angle-of-attack variation on the location of the neutral point. Explain the contribution of engine nacelles.						
081 04 03 05	**Location of centre of gravity**						
LO	Explain the influence of the CG location on static longitudinal stability of the aeroplane. Explain the CG forward and aft limits with respect to: longitudinal control forces; elevator effectiveness; stability. Define 'static margin'.	x	x				
081 04 03 06	**The Cm–α graph**						
LO	Define the 'aerodynamic pitching moment coefficient (Cm)'. Describe the Cm–α graph with respect to: positive and negative sign; linear relationship; angle of attack for equilibrium state; relationship between the slope of the graph and static stability.	x	x				
081 04 03 07	**Factors affecting the Cm–α graph**						
LO	Explain: the effect on the Cm–α graph of a shift of CG in the forward and aft direction; the effect on the Cm–α graph when the elevator is moved up or down; the effect on the Cm–α graph when the trim is moved; the effect of the wing contribution and how it is affected by CG location; the effect of the fuselage contribution and how it is affected by CG location; the tail contribution; the effect of aerofoil camber change.	x	x				

081 04 03 08	**The elevator position versus speed graph (IAS)**						
LO	Describe the elevator position speed graph. Explain: the gradient of the elevator position speed graph; the influence of the airspeed on the stick position stability.	x	x				
081 04 03 09	**Factors affecting the elevator position–speed graph**						
LO	Explain the contribution on the elevator position–speed graph of: the location of centre of gravity; the trim (trim tab and stabiliser trim); high-lift devices.	x	x				
081 04 03 10	**The stick force versus speed graph (IAS)**						
LO	Define the 'stick force speed graph'. Describe the minimum gradient for stick force versus speed that is required for certification according to CS-23 and CS-25. Explain the importance of the stick force gradient for good flying qualities of an aeroplane. Identify the trim speed in the stick force speed graph. Explain how a pilot perceives stable static longitudinal stick force stability.	x	x				
081 04 03 11	**Factors affecting the stick force versus speed graph**						
LO	Explain the contribution of: the location of the centre of gravity; the trim (trim tab and stabiliser trim); down spring; bob weight; friction.	x	x				
LO	Explain the contribution of Mach number — Ref. 081 02 03 04.	x					

081 04 03 12	**The manoeuvring stability/stick force per G**						
LO	Define the 'stick force per G'. Explain why: the stick force per G has a prescribed minimum and maximum value; the stick force per G decreases with pressure altitude at the same indicated airspeed.	x	x				
081 04 03 13	**Intentionally left blank**						
081 04 03 14	**Factors affecting the manoeuvring stability/stick force per G**						
LO	Explain the influence on stick force per G of: CG location; trim setting; a down spring in the control system; a bob weight in the control system.	x	x				
081 04 03 15	**Stick force per G and the limit-load factor**						
LO	Explain why the prescribed minimum and maximum values of the stick force per G are dependent on the limit-load factor. Calculate the stick force to achieve a certain load factor at a given manoeuvre stability.	x	x				
081 04 03 16	**Dynamic longitudinal stability**						
LO	Describe the phugoid and short-period motion in terms of period, damping, variations (if applicable) in speed, altitude and angle of attack. Explain why short-period motion is more important for flying qualities than the phugoid. Define and describe 'pilot-induced oscillations'. Explain the effect of high altitude on dynamic stability. Describe the influence of the CG location on the dynamic longitudinal stability of the aeroplane.	x	x				
081 04 04 00	**Static directional stability**						
LO	Define 'static directional stability'.	x	x				

	Explain the effects of static directional stability being too weak or too strong.						
081 04 04 01	**Sideslip angle β**						
LO	Define 'sideslip angle'. Identify β as the symbol used for the sideslip angle.	x	x				
081 04 04 02	**Yaw-moment coefficient Cn**						
LO	Define the 'yawing-moment coefficient Cn'. Define the relationship between Cn and β for an aeroplane with static directional stability.	x	x				
081 04 04 03	**Cn–β graph**						
LO	Explain why: Cn depends on the angle of sideslip; Cn equals zero for that angle of sideslip that provides static equilibrium about the aeroplane's normal axis; if no asymmetric engine thrust, flight control or loading condition prevails, the equilibrium angle of sideslip equals zero. Identify how the slope of the Cn–β graph is a measure for static directional stability.	x	x				
081 04 04 04	**Factors affecting static directional stability**						
LO	Describe how the following aeroplane components contribute to static directional stability: wing; fin; dorsal fin; ventral fin; angle of sweep of the wing; angle of sweep of the fin; fuselage at high angles of attack; strakes. Explain why both the fuselage and the fin contribution reduce static directional stability when the CG moves aft.	x	x				
081 04 05 00	**Static lateral stability**						

LO	Define 'static lateral stability'. Explain the effects of static lateral stability being too weak or too strong.	x	x				
081 04 05 01	**Bank angle Ø**						
LO	Define 'bank angle Ø'.	x	x				
081 04 05 02	**The roll-moment coefficient Cl**						
LO	Define the 'roll-moment coefficient Cl'.	x	x				
081 04 05 03	**Contribution of sideslip angle β**						
LO	Explain how without coordination the bank angle creates sideslip angle.	x	x				
081 04 05 04	**The Cl–β graph**						
LO	Describe Cl–β graph. Identify the slope of the Cl–β graph as a measure for static lateral stability.	x	x				
081 04 05 05	**Factors affecting static lateral stability**						
LO	Explain the contribution to the static lateral stability of: dihedral, anhedral; high wing, low wing; sweep angle of the wing; ventral fin; vertical tail. Define 'dihedral effect'.	x	x				
081 04 05 06	**Intentionally left blank**						
081 04 06 00	**Dynamic lateral/directional stability**						
081 04 06 01	**Effects of asymmetric propeller slipstream**						
081 04 06 02	**Tendency to spiral dive**						
LO	Explain how lateral and directional stability are coupled. Explain how high-static directional stability and a low-static lateral stability may cause spiral divergence (unstable spiral dive), and under which conditions the spiral dive mode is neutral or stable. Describe an unstable spiral dive mode with respect to deviations in speed, bank angle,	x	x				

	nose low-pitch attitude and decreasing altitude.						
081 04 06 03	**Dutch roll**						
LO	Describe Dutch roll. Explain: why Dutch roll occurs when the static lateral stability is large compared with static directional stability; the condition for a stable, neutral or unstable Dutch roll motion; the function of the yaw damper; the actions to be taken in case of non-availability of the yaw damper.	x	x				
LO	State the effect of Mach number on Dutch roll.	x					
081 04 06 04	**Effects of altitude on dynamic stability**						
LO	Explain that increased pressure altitude reduces dynamic lateral/directional stability.	x	x				
081 05 00 00	**CONTROL**						
081 05 01 00	**General**						
081 05 01 01	**Basics, the three planes and three axes**						
LO	Define: lateral axis; longitudinal axis; normal axis. Define: pitch angle; bank angle; yaw angle. Describe the motion about the three axes. Name and describe the devices that control these motions.	x	x				
081 05 01 02	**Camber change**						
LO	Explain how camber is changed by movement of a control surface.	x	x				
081 05 01 03	**Angle-of-attack change**						

LO	Explain the influence of local angle-of-attack change by movement of a control surface.	x	x				
081 05 02 00	**Pitch (longitudinal) control**						
081 05 02 01	**Elevator/all-flying tails**						
LO	Explain the working principle of the elevator/all-flying tail and describe its function. Describe the loads on the tailplane over the whole speed range.	x	x				
081 05 02 02	**Downwash effects**						
LO	Explain the effect of downwash on the tailplane angle of attack. Explain in this context the use of a T-tail or stabiliser trim.	x	x				
081 05 02 03	**Ice on tail**						
LO	Explain how ice can change the aerodynamic characteristics of the tailplane. Explain how this can affect the tail's proper function.	x	x				
081 05 02 04	**Location of centre of gravity**						
LO	Explain the relationship between elevator deflection and CG location to produce a given aeroplane response. Explain the effect of forward CG limit on pitch control.	x	x				
081 05 02 05	**Moments due to engine thrust**						
LO	Describe the effect of engine thrust on pitching moments for different engine locations.	x	x				
081 05 03 00	**Yaw (directional) control**						
LO	Explain the working principle of the rudder and describe its function. State the relationship between rudder deflection and the moment about the normal axis; Describe the effect of sideslip on the moment about the normal axis.	x	x				
081 05 03 01	**Rudder limiting**						

LO	Explain why and how rudder deflection is limited on transport aeroplanes.	x					
081 05 04 00	**Roll (lateral) control**						
081 05 04 01	**Ailerons**						
LO	Explain the functioning of ailerons. Describe the adverse effects of ailerons. (Refer to 081 05 04 04 and 081 06 01 02) Explain in this context the use of inboard and outboard ailerons. Explain outboard-aileron lockout and conditions under which this feature is used. Describe the use of aileron deflection in normal flight, flight with sideslip, crosswind landings, horizontal turns, flight with one engine out. Define 'roll rate'. List the factors that affect roll rate. Flaperons, aileron droop.	x	x				
081 05 04 02	**Intentionally left blank**						
081 05 04 03	**Spoilers**						
LO	Explain how spoilers can be used to control the rolling movement in combination with or instead of the ailerons.	x	x				
081 05 04 04	**Adverse yaw**						
LO	Explain how the use of ailerons induces adverse yaw.	x	x				
081 05 04 05	**Means to avoid adverse yaw**						
LO	Explain how the following reduce adverse yaw: Frise ailerons; differential aileron deflection; rudder aileron cross-coupling; roll spoilers.	x	x				
081 05 05 00	**Roll/yaw interaction**						
LO	Explain the secondary effect of roll. Explain the secondary effect of yaw.	x	x				
081 05 06 00	**Means to reduce control forces**						

081 05 06 01	**Aerodynamic balance**						
LO	Describe the purpose of aerodynamic balance. Describe the working principle of the nose and horn balance. Describe the working principle of internal balance. Describe the working principle and the application of: balance tab; anti-balance tab; spring tab; servo tab.	x	x				
081 05 06 02	**Artificial means**						
LO	Describe fully powered controls. Describe power-assisted controls. Explain why artificial feel is required. Explain the inputs to an artificial feel system.	x	x				
081 05 07 00	**Mass balance**						
LO	Refer to 081 06 01 01 for mass balance. Refer to 081 04 03 11 and 081 04 03 14 for bob weight.	x	x				
081 05 08 00	**Trimming**						
081 05 08 01	**Reasons to trim**						
LO	State the reasons for trimming devices. Explain the difference between a trim tab and the various balance tabs.	x	x				
081 05 08 02	**Trim tabs**						
LO	Describe the working principle of a trim tab including cockpit indications.	x	x				
081 05 08 03	**Stabiliser trim**						
LO	Explain the advantages and disadvantages of a stabiliser trim compared with a trim tab. Explain elevator deflection when the aeroplane is trimmed in the case of fully powered and power-assisted pitch controls.	x	x				

	Explain the factors influencing stabiliser setting. Explain the influence of take-off stabiliser trim setting on rotation characteristics and stick force during take-off rotation at extremes of CG position. Discuss the effects of jammed and runaway stabiliser. Explain the landing considerations with a jammed stabiliser.						
081 06 00 00	**LIMITATIONS**						
081 06 01 00	**Operating limitations**						
081 06 01 01	**Flutter**						
LO	Describe the phenomenon of flutter and list the factors: elasticity; backlash; aeroelastic coupling; mass distribution; structural properties IAS. List the flutter modes of an aeroplane: wing, tailplane, fin, control surfaces including tabs. Describe the use of mass balance to alleviate the flutter problem by adjusting the mass distribution: wing-mounted pylons; control surface mass balance. List the possible actions in the case of flutter in flight.	x	x				
081 06 01 02	**Aileron reversal**						
LO	Describe the phenomenon of aileron reversal: at low speeds;	x	x				

	at high speeds. Describe the aileron reversal speed in relationship to VNE and VNO.						
081 06 01 03	**Landing gear/flap operating**						
LO	Describe the reason for flap/landing gear limitations. define 'VLO'; define 'VLE'. Explain why there is a difference between VLO and VLE in the case of some aeroplane types. Define 'VFE'. Describe flap design features to prevent overload.	x	x				
081 06 01 04	**VMO, VNO, VNE**						
LO	Define 'VMO', 'VNO', 'VNE'. Describe the differences between VMO, VNO and VNE. Explain the dangers of flying at speeds close to VNE.	x	x				
081 06 01 05	**MMO**						
LO	Define 'MMO' and state its limiting factors.	x					
081 06 02 00	**Manoeuvring envelope**						
081 06 02 01	**Manoeuvring-load diagram**						
LO	Describe the manoeuvring-load diagram. Define limit and ultimate load factor and explain what can happen if these values are exceeded. Define 'VA', 'VC', 'VD'. Identify the varying features on the diagram: load factor 'n'; speed scale, equivalent airspeed, EAS; CLMAX boundary; accelerated stall speed (refer to 081 01 08 02). Describe the relationship between VMO and VC.	x	x				

	State all the manoeuvring limit load factors applicable to CS-23 and CS-25 aeroplanes. Explain the relationship between VA and VS in a formula. Explain the adverse consequences of exceeding VA.						
081 06 02 02	**Factors affecting the manoeuvring-load diagram**						
LO	State the relationship of mass to: load factor limits; accelerated stall speed limit; VA and VC. Explain the relationship between VA, aeroplane mass and altitude. Calculate the change of VA with changing mass.	x	x				
LO	Describe the effect of altitude on Mach number, with respect to limitations. Explain why VA loses significance at higher altitude where compressibility effects occur. Define 'MC' and 'MD' and their relation with VC and VD.	x					
081 06 03 00	**Gust envelope**						
081 06 03 01	**Gust-load diagram**						
LO	Recognise a typical gust-load diagram. Identify the various features shown on the diagram: gust-load factor 'n'; speed scale, equivalent airspeed and EAS; CLMAX boundary; vertical gust velocities; relationship of VB to VC and VD. gust limit load factor. Define 'VRA', 'VB'. Discuss considerations for the selection of this speed.	x	x				

	Explain the adverse effects on the aeroplane when flying in turbulence.						
081 06 03 02	**Factors affecting the gust-load diagram.**						
LO	Explain the relationship between the gust-load factor, lift-curve slope, density ratio, wing loading, EAS and equivalent vertical sharp-edged gust velocity and perform relevant calculations.	x	x				
081 07 00 00	**PROPELLERS**						
081 07 01 00	**Conversion of engine torque to thrust**						
LO	Explain the resolution of aerodynamic force on a propeller blade element into lift and drag or into thrust and torque. Describe propeller thrust and torque and their variation with IAS.	x	x				
081 07 01 01	**Relevant propeller parameters**						
LO	Describe the geometry of a typical propeller blade element at the reference section: blade chord line; propeller rotational velocity vector; true-airspeed vector; blade angle of attack; pitch or blade angle; advance or helix angle; define 'geometric pitch', 'effective pitch' and 'propeller slip'. Remark: For theoretical knowledge examination purposes, the following definition is used for geometric pitch: the theoretical distance a propeller would advance in one revolution at zero blade angle of attack. Define 'fine and coarse pitch'.	x	x				
081 07 01 02	**Blade twist**						
LO	Define 'blade twist'. Explain why blade twist is necessary.	x	x				
081 07 01 03	**Fixed pitch and variable pitch/constant speed**						
LO	List the different types of propellers:	x	x				

	fixed pitch; adjustable pitch or variable pitch (non-governing); variable pitch (governing)/ constant speed. Discuss the advantages and disadvantages of fixed-pitch and constant-speed propellers. Discuss climb and cruise propellers. Explain the relationship between blade angle, blade angle of attack and airspeed for fixed and variable pitch propellers. Given a diagram, explain the forces acting on a rotating blade element in normal, feathered, windmilling and reverse operation. Explain the effects of changing propeller pitch at constant IAS.						
081 07 01 04	**Propeller efficiency versus speed**						
LO	Define 'propeller efficiency'. Explain the relationship between propeller efficiency and speed (TAS). Plot propeller efficiency against speed for the types of propellers listed in 081 07 01 03 above. Explain the relationship between blade angle and thrust.	x	x				
081 07 01 05	**Effects of ice on propeller**						
LO	Describe the effects of ice on a propeller.	x	x				
081 07 02 00	**Engine failure**						
081 07 02 01	**Windmilling drag**						
LO	List the effects of an inoperative engine on the performance and controllability of an aeroplane: thrust loss/drag increase; influence on yaw moment during asymmetric power.	x	x				
081 07 02 02	**Feathering**						
LO	Explain the reasons for feathering and the effect on performance and controllability.	x	x				

	Influence on yaw moment during asymmetric power.						
081 07 03 00	**Design features for power absorption**						
LO	Describe the factors of propeller design that increase power absorption.	x	x				
081 07 03 01	**Aspect ratio of blade**						
LO	Define 'blade-aspect ratio'.	x	x				
081 07 03 02	**Diameter of propeller**						
LO	Explain the reasons for restricting propeller diameter.	x	x				
081 07 03 03	**Number of blades**						
LO	Define 'solidity'. Describe the advantages and disadvantages of increasing the number of blades.	x	x				
081 07 03 04	**Propeller noise**						
LO	Explain how propeller noise can be minimised.	x	x				
081 07 04 00	**Secondary effects of propellers**						
081 07 04 01	**Torque reaction**						
LO	Describe the effects of engine/propeller torque. Describe the following methods for counteracting engine/propeller torque: counter-rotating propellers; contra-rotating propellers.	x	x				
081 07 04 02	**Gyroscopic precession**						
LO	Describe what causes gyroscopic precession. Describe the effect on the aeroplane due to the gyroscopic effect.	x	x				
081 07 04 03	**Asymmetric slipstream effect**						
LO	Describe the possible asymmetric effects of the rotating propeller slipstream.	x	x				
081 07 04 04	**Asymmetric blade effect**						
LO	Explain the asymmetric blade effect (also called P factor). Explain influence of direction of rotation on critical engine on twin engine aeroplanes.	x	x				

081 08 00 00	**FLIGHT MECHANICS**						
081 08 01 00	**Forces acting on an aeroplane**						
081 08 01 01	**Straight horizontal steady flight**						
LO	Describe the forces acting on an aeroplane in straight horizontal steady flight. List the four forces and state where they act. Explain how the four forces are balanced. Describe the function of the tailplane.	x	x				
081 08 01 02	**Straight steady climb**						
LO	Define ‘γ flight-path angle’. Describe the relationship between pitch attitude, flight-path angle and angle of attack for the zero-wind, zero-bank and sideslip conditions. Describe the forces acting on an aeroplane in a straight steady climb. Name the forces parallel and perpendicular to the direction of flight. Apply the formula relating to the parallel forces ($T = D + W \sin \gamma$). Apply the formula relating to the perpendicular forces ($L = W \cos \gamma$). Explain why thrust is greater than drag. Explain why lift is less than weight. Explain the formula (for small angles) giving the relationship between flight-path angle, thrust, weight and lift–drag ratio, and use this formula for simple calculations. Explain how IAS, angle of attack and flight-path angle change in a climb performed with constant pitch attitude and normal thrust decay with altitude.	x	x				
081 08 01 03	**Straight steady descent**						
LO	Describe the forces acting on an aeroplane in a straight steady descent. Name the forces parallel and perpendicular to the direction of flight. Apply the formula parallel to the direction of flight ($T = D – W \sin \gamma$).	x	x				

 V1, June 2016

	Apply the formula relating to the perpendicular forces (L = W cos γ). Explain why lift is less than weight. Explain why thrust is less than drag.						
081 08 01 04	**Straight steady glide**						
LO	Describe the forces acting on an aeroplane in a straight steady glide. Name the forces parallel and perpendicular to the direction of flight. Apply the formula for forces parallel to the direction of flight (D = W sin γ); Apply the formula for forces perpendicular to the direction of flight (L = W cos γ). Describe the relationship between the glide angle and the lift–drag ratio. Describe the relationship between angle of attack and the best lift–drag ratio. Explain the effect of wind component on glide angle, duration and distance. Explain the effect of mass change on glide angle, duration and distance. Explain the effect of configuration change on glide angle, duration and distance. Describe the relation between TAS and sink rate including minimum glide angle and minimum sink rate.	x	x				
081 08 01 05	**Steady coordinated turn**						
LO	Describe the forces acting on an aeroplane in a steady coordinated turn. Resolve the forces acting horizontally and vertically during a coordinated turn ($\tan\phi = \frac{V^2}{gR}$). Describe the difference between a coordinated and an uncoordinated turn and explain how to correct an uncoordinated turn using turn and slip indicator. Explain why the angle of bank is independent of mass and only depends on TAS and radius of turn.	x	x				

	Resolve the forces to show that for a given angle of bank the radius of turn is determined solely by airspeed ($\tan\phi = \frac{V^2}{gR}$). Calculate the turn radius, load factor and the time for a complete turn for relevant parameters given for a steady turn. Discuss the effects of bank angle on: load factor; angle of attack; thrust; drag. Define 'angular velocity'. Define 'rate of turn' and 'rate-one turn'. Explain the influence of TAS on rate of turn at a given bank angle.						
081 08 02 00	**Asymmetric thrust**						
LO	Describe the effects on the aeroplane during flight with asymmetric thrust including both jet engine and propeller-driven aeroplanes. Discuss critical engine, include effect of crosswind when on the ground. Explain effect of steady asymmetric flight on a conventional (ball) slip indicator.	x	x				
081 08 02 01	**Moments about the normal axis**						
LO	Describe the moments about the normal axis. Explain the yawing moments about the CG. Describe the change to yawing moment caused by power changes. Describe the changes to yawing moment caused by engine distance from CG. Describe the methods to achieve balance.	x	x				
081 08 02 02	**Intentionally left blank**						
081 08 02 03	**Forces parallel to the lateral axis**						
LO	Explain: the force on the vertical fin;	x	x				

	the fuselage side force due to sideslip; the use of bank angle to tilt the lift vector. Explain how bank angle and sideslip are related in a steady asymmetric flight. Explain why the bank angle must be limited. Explain the effect on fin angle of attack due to sideslip.						
081 08 02 04	**Influence of aeroplane mass**						
LO	Explain why controllability with one engine inoperative is a typical problem encountered at low aeroplane mass.	x	x				
081 08 02 05	**Intentionally left blank**						
081 08 02 06	**Secondary propeller effects**						
LO	Describe propeller effects: slip stream; torque reaction; asymmetric blade effect.	x	x				
081 08 02 07	**Intentionally left blank**						
081 08 02 08	**VMCA**						
LO	Define 'VMCA'. Describe how VMCA is determined. Explain the influence of the CG location.	x	x				
081 08 02 09	**VMCL**						
LO	Define 'VMCL'. Describe how VMCL is determined. Explain the influence of the CG location.	x	x				
081 08 02 10	**VMCG**						
LO	Define 'VMCG'. Describe how VMCG is determined. Explain the influence of the CG location.	x	x				
081 08 02 11	**Influence of density**						
LO	Describe the influence of density. Explain why VMCA, VMCL and VMCG reduce with an increase in altitude and temperature.	x	x				

081 08 03 00	**Particular points on a polar curve**						
LO	Identify the particular points on a polar curve and explain their significance, assuming a parabolic approximation.	x	x				

N. SUBJECT 082 — PRINCIPLES OF FLIGHT (HELICOPTER)

(1) VOCABULARY OF MECHANICS

Speed is a scalar quantity, it has only magnitude.

Velocity is a vector quantity having magnitude and direction.

The velocity (speed) of a point of the aerofoil in the rotation around its axis is the 'linear' or 'tangential' velocity (speed).

The rotational velocity (speed) of a body around an axis is an angular velocity (speed) expressed in revolutions per minute (RPM), or degrees per second (deg/s), or radians per second (rad/s).

Density is the mass of the fluid per unit volume, in SI units kg/m3.

(2) AERONAUTICAL DEFINITIONS

The blade is the aerofoil between a root radius and the tip radius (R) attached to the hub with hinges or flexible elements.

The cross section of a blade perpendicular to the feathering axis, the blade section at a distance (radius) from the hub centre shows the shape of the aerofoil.

Such section is characterised by a contour, a leading and trailing edge, a chord line, a chord, a camber line, the maximum thickness or depth, the thickness-to-chord ratio.

The blade element is a spanwise piece of the blade. It is assumed that its radial extension is small such that the aerodynamic forces don't vary with radial distance. The aerodynamic forces on the blade element produce lift, drag and a pitching moment.

The centre of pressure is defined as the point on the chord where the resultant of all aerodynamic forces acts such that the pitching moment about this point is zero.

The planform of the blade is the shape of the blade as seen from above.

The pitch angle of a section is the angle between the chord line and a reference plane.

(The reference planes will be defined later in this text.)

The blade is without twist when the pitch angle is constant from root to tip.

The blade is twisted when the pitch angle of the sections varies as a function of the radial distance (the chord lines are not parallel). If the pitch angle decreases towards the tip, this is called washout.

The vector sum of the undisturbed upstream velocity and the thrust-induced velocity is the relative velocity.

In the helicopter theory we use the following definitions for ‘angle of attack’, ‘lift’ and ‘drag’:

The angle between the relative velocity and the chord line is the angle of attack ▯ or AoA, called effective angle of attack. The geometric angle of attack is the angle between the undisturbed upstream velocity and the chord line.

Lift is the component of the aerodynamic force on a blade element perpendicular to the relative velocity.

Profile drag is the component of the aerodynamic force on a blade element parallel to the relative velocity.

Profile drag is produced by the pressure forces and by skin-friction forces that act on the surface of the blade element.

The component of the drag force due to the pressure forces is the pressure or form drag.

The component of the drag due to the shear forces over the aerofoil is termed skin-friction drag.

The sum of the pressure drag and the skin-friction drag is the profile drag.

(3) HELICOPTER CHARACTERISTICS

Disc loading is by definition the mass M or weight W of the helicopter divided by the area of the disc.

(The disc area is ⍰R2, R being the blade-tip radius)

The disc loading is M/(⍰R2) or W/(⍰R2).

Blade loading is by definition the mass (weight) divided by the total planform area of the blades.

The area of a rectangular blade is given by chord times tip radius. For tapered blades, the mean geometric chord is taken as an approximately equivalent chord.

Blade loading is defined as the mass or weight of the helicopter divided by the total area of all blades.

Rotor solidity is the ratio of the total blade area to the disc area.

(4) PLANES, AXES, REFERENCE SYSTEMS OF THE ROTOR

Shaft axis: the axis of the rotor shaft (mast).

Hub plane: plane perpendicular to the shaft axis through the centre of the hub.

Tip-path plane: the plane traced out by the blade tips. This plane is also the

no-flapping plane.

Virtual rotation axis: axis through the centre of the hub and perpendicular to the tip-path plane. Another name for this axis is no-flapping axis.

Rotor-disc plane: another name for the tip-path plane.

Rotor disc: the disc traced out by the blade tips in the tip-path plane.

Plane of rotation: the plane parallel to the tip-path plane through the hub centre.

No-feathering plane: is also called the control plane. This is the reference plane relative to which the pitch of the rotating blade has no variation during a full rotation. The control plane is parallel to the swash plate in the simple feathering mechanism (no flap-feathering coupling).

Control axis or axis of no-feathering. Axis through the hub centre and perpendicular to the no-feathering or control plane.

The azimuthal angle of the blade is the angle in the rotor-disc plane counted in the rotation sense from the direction opposite to the helicopter velocity.

(5) REFERENCE SYSTEMS (sometimes called frames of reference)

There are three different reference systems in which the movement of the blades can be studied or observed:

The tip-path plane with the virtual rotation axis: the observer in this system observes no flapping, only cyclic feathering.

The no-feathering plane (or control plane) with the control axis: the observer in this system observes no feathering, only cyclic flapping.

The hub plane and shaft axis: the observer in this system observes both cyclic flapping and cyclic feathering.

(6) ANGLES OF THE BLADES, INDUCED VELOCITY

Pitch angle of a blade section: the angle between the chord line of the section and the hub plane (the reference plane), also called local pitch angle.

Pitch angle of the blade: the pitch angle at 75 % of the tip radius.

Flapping angle: the angle between the longitudinal axis of the blade and the hub plane.

Coning angle: the angle between the longitudinal axis of the blade and the tip-path plane.

Advance angle: the azimuthal angle between the flapping axis and the point where the pitch link is connected to the swash plate (not to be confused with the phase lag from pitch input to flapping response).

The induced velocity is the velocity induced by the rotor thrust in the plane of the rotor disc (about 10 m/s for a light helicopter in hover). The slipstream velocity continues to increase downstream of the rotor. In the hover out-of-ground-effect (HOGE), the velocity in the ultimate wake is equal to two times the induced velocity.

Aerodynamic forces on the BLADES and the ROTOR.

The airflow around the blade element produces an aerodynamic force resolvable in two components: lift and drag. Lift is perpendicular to the relative air velocity, and drag is parallel to the relative air velocity.

The aerodynamic force may also be resolved into thrust perpendicular to the tip-path plane (or plane of rotation) and drag parallel to the tip-path plane. This drag is the sum of the profile drag and the induced drag.

Because the angle between the lift vector and the thrust vector is very small, the magnitudes of these two vectors may be taken as equal.

The blade thrust is the sum of the thrusts of all blade elements along the blade radius.

The sum of the thrusts of all blades is the (total) rotor thrust acting perpendicular to the tip-path plane in the direction of the virtual rotation axis.

The result of the induced drag forces on all the blade elements of all blades is a torque on the shaft which — multiplied by the angular velocity of the rotor — gives the required induced power.

The result of all the profile drags is a torque on the shaft which — multiplied by the angular velocity of the rotor — gives the required profile power.

(7) TYPES OF ROTOR HUBS

There are basically four types of rotor hubs in use:

1. Teetering rotor or seesaw rotor: The two blades are connected together; the hinge is on the shaft axis. A variation is the gimballed hub; the blades and the hub are attached to the rotor shaft by means of a gimbal or universal joint.
2. Fully articulated rotor: The rotor has more than two blades. Each blade has a flapping hinge, a lead-lag hinge and a feathering bearing.
3. Hingeless rotor: There are no flap and lead-lag hinges. They are replaced by flexible elements at the root of the blades which allow flapping and lead-lag movements. The feathering bearing allows feathering of the blade.
4. Bearingless rotor: There are no hinges or bearings. Flapping and lead or lag are obtained by flexing flexible elements called elastomeric hinges and feathering is obtained by twisting the element.

Two remarks:

1. Hinge offset and equivalent hinge offset

The hinge offset is the distance between the shaft axis and the axis of the hinge. In the hingeless and bearingless rotor, we define an equivalent hinge offset.

2. Elastomeric hinges

This bearing consists of alternate layers of elastomer and metal. The elasticity in the elastomer allows the movements of flapping, lead-lag and feathering.

(8) DRAG AND POWERS

The induced power is the power resulting from the induced velocity in the rotor disc for the generation of lift. For any given thrust, the induced power is minimum when the induced velocity is uniform over the rotor disc. Such velocity distribution can be approximated by using some blade twist (a truly uniform velocity cannot be obtained).

The rotor profile drag results from the component opposite to the blade velocities of all the profile drags of the blade elements of all the blades.

The resulting power is the rotor profile power or the profile-drag power (sum of the powers to overcome the torque).

The parasite drag is the drag on the helicopter fuselage including the drag of the rotor hub and all external equipment such as wheels, winch, etc. The tail-rotor drag is also included in the parasite drag. The power to overcome this drag is the parasite power.

In the level flight at constant speed, the main-rotor-induced power, the rotor profile power and the parasite power are summed to give the total power required to drive the main rotor.

The tail-rotor-induced power and the tail-rotor profile power are summed to give the power required to drive the tail rotor.

The power required to drive the auxiliary services, such as oil pumps and electrical generators, is the accessory or ancillary power. The power to overcome the mechanical friction in the transmissions is included in the accessory power.

The total power required in level flight at constant speed is the sum of the total power for the main rotor, the power for the tail rotor and the accessory power.

In the low-speed region, the required power in straight and level flight decreases as speed increases. The phenomenon is called translational lift.

The term limited power means that the total power required to hover OGE is greater than the available power.

(9) PHASE ANGLE IN FLAPPING MOVEMENT OF THE BLADE

The cyclic movement tilts the rotor disc in the direction of the intended helicopter velocity.

The flapping response is approximately 90° later than the applied cyclic pitch (somewhat less than 90° for hingeless rotors).

The pitch mechanism consists of the swash plate and for each blade a pitch link attached to the swash plate and a pitch horn attached to the blade.

(10) AXES THROUGH THE CENTRE OF THE HELICOPTER

Longitudinal axis or roll axis: Straight line through the centre of gravity of the helicopter from the nose to the tail about which the helicopter can roll left or right.

Lateral axis, transverse axis or pitch axis: Straight line through the centre of gravity of the helicopter about which the helicopter can pitch its nose up or down. (This axis is also perpendicular to the reference plane of the aircraft.)

Normal axis or yaw axis: Straight line perpendicular to the plane defined by the longitudinal and lateral axes and about which the helicopter can yaw.

Aircraft reference plane: The plane with respect to which a subset of the components that constitutes the major part of the aircraft is symmetrically disposed in the port and starboard sense.

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
080 00 00 00	**PRINCIPLES OF FLIGHT**						
082 00 00 00	**PRINCIPLES OF FLIGHT — HELICOPTER**						
082 01 00 00	**SUBSONIC AERODYNAMICS**						
082 01 01 00	**Basic concepts, laws and definitions**						
082 01 01 01	**SI units and conversion of units**						
LO	List the fundamental quantities and units in SI system: mass (kg), length (m), time (s).			x	x	x	
LO	Show and apply tables of conversion of units of English units to SI units and vice versa.			x	x	x	
LO	The units of the physical quantities should be mentioned when they are introduced.			x	x	x	
082 01 01 02	**Definitions and basic concepts about air**						
LO	Describe air temperature and pressure as functions of height.			x	x	x	
LO	Use the table of the International Standard Atmosphere.			x	x	x	

LO	Define air density; explain the relationship between density, pressure and temperature.			x	x	x	
LO	Explain the influence of moisture content on density.			x	x	x	
LO	Define pressure altitude and density altitude.			x	x	x	
082 01 01 03	**Newton's laws**						
LO	Describe Newton's second law: force equals product of mass and acceleration.			x	x	x	
LO	Distinguish mass and weight, units.			x	x	x	
LO	Describe the other form of the second law, applicable to thrust.			x	x	x	
LO	Describe Newton's third law: action and reaction, force and torque.			x	x	x	
082 01 01 04	**Basic concepts of airflow**						
LO	Describe steady and unsteady airflow.			x	x	x	
LO	Define 'streamline' and 'stream tube'.			x	x	x	
LO	Equation of continuity or mass conservation.			x	x	x	
LO	Mass-flow rate through a stream-tube section.			x	x	x	
LO	Describe the relation between the external force on a stream tube and the momentum variation of the airflow.			x	x	x	
LO	State the Bernoulli's equation in a non-viscous airflow, use this equation to explain and define static pressure, dynamic pressure and total pressure.			x	x	x	
LO	Define the stagnation point in a flow around an aerofoil and explain the pressure obtained in the stagnation point.			x	x	x	
LO	Describe the pitot system and explain the measurement of airspeed (no compressibility effects).			x	x	x	
LO	Define TAS, IAS, CAS.			x	x	x	
LO	Define a two-dimensional airflow and an aerofoil of infinite span. Explain the difference between a two-dimensional and a three-dimensional airflow.			x	x	x	
LO	Explain that viscosity is a feature of a fluid (gas or liquid).			x	x	x	

LO	Describe the airflow over a flat surface and explain the tangential friction between air and surface and the development of a boundary layer.			x	x	x	
LO	Define a laminar boundary layer, a turbulent boundary layer and the transition from laminar to turbulent. Show the influence of the roughness of the surface on the position of the transition point.			x	x	x	
082 01 02 00	**Two-dimensional airflow**						
082 01 02 01	**Aerofoil section geometry**						
LO	Define the terms ‘aerofoil section’, ‘aerofoil element’, ‘chord line’, ‘chord’, ‘thickness’, ‘thickness-to-chord ratio of section’, ‘camber line’, ‘camber’, ‘leading-edge radius’.			x	x	x	
LO	Describe different aerofoil sections, symmetrical and asymmetrical.			x	x	x	
082 01 02 02	**Aerodynamic forces on aerofoil elements**						
LO	Define the ‘angle of attack’.			x	x	x	
LO	Describe the pressure distribution on the upper and lower surface.			x	x	x	
LO	Describe the boundary layers on the upper and lower surfaces for small angles of attack (below the onset of stall).			x	x	x	
LO	Describe the resultant force due to the pressure distribution and the friction at the element, the boundary layers and the velocities in the wake, the loss of momentum due to friction forces.			x	x	x	
LO	Resolve the aerodynamic force into the components lift and drag.			x	x	x	
LO	Define the lift coefficient and the drag coefficient, equations.			x	x	x	
LO	Show that the lift coefficient is a function of the angle of attack, draw the graph.			x	x	x	
LO	Explain how drag is caused by pressure forces on the surfaces and by friction forces in the boundary layers. Define the term ‘profile drag’.			x	x	x	
LO	Draw the graph of lift (or of the lift coefficient) as a function of drag or of the drag coefficient and define the lift–drag ratio.			x	x	x	

LO	Use the equations of lift and drag to show the influence of speed and density on lift and drag for a given angle of attack and to calculate lift and drag.			x	x	x	
LO	Define the action line of the aerodynamic force, the centre of pressure, the pitching moment.			x	x	x	
LO	Know that the pitching moment about the centre of pressure is zero by definition.			x	x	x	
LO	Know that symmetrical aerofoils have the centre of pressure a quarter chord behind the leading edge independently of the angle of attack as long as the angle of attack remains smaller than the angle of stall.			x	x	x	
LO	Taking an asymmetrical aerofoil section with different cambers, know the position of the centre of pressure, the influence of the angle of attack on the centre of pressure and the pitching moment about a line which is a quarter chord behind the leading edge.			x	x	x	
082 01 02 03	**Stall**						
LO	Explain the boundary layer separation when the angle of attack increases beyond stall onset and the decrease of lift and the increase of drag. Define the 'separation point and line'.			x	x	x	
LO	Draw a graph of lift and drag coefficient as a function of the angle of attack before and beyond the stall onset.			x	x	x	
LO	Describe how the stall phenomenon displaces the centre of pressure and how pitching moments appear about the line at quarter chord behind the leading edge.			x	x	x	
082 01 02 04	**Disturbances due to profile contamination**						
LO	Explain ice contamination, the modification of the section profile and the surfaces due to ice and snow, influence on lift and drag and L–D ratio, on the angle of attack at stall onset, effect of the weight increase.			x	x	x	
LO	Explain the erosion effect of heavy rain on the wing and subsequent increase of profile drag.			x	x	x	
082 01 03 00	**Three-dimensional airflow around a blade (wing) and a fuselage**						
082 01 03 01	**The blade**						

LO	Describe different planforms of blades, and describe untwisted and twisted blades.			x	x	x	
LO	Define the root chord and the tip chord, the mean chord, the aspect ratio and the blade twist.			x	x	x	
082 01 03 02	**Airflow pattern and influence on lift**						
LO	Explain the spanwise flow in the case of a blade and the appearance of the tip vortices which are a loss of energy.			x	x	x	
LO	Show that the strength of the vortices increases as the angle of attack and the lift increase.			x	x	x	
LO	Show that downwash causes vortices.			x	x	x	
LO	Define the effective air velocity as the resultant of the undisturbed air velocity and the induced velocity and define the effective angle of attack.			x	x	x	
LO	Explain the spanwise lift distribution and how it can be modified by twist.			x	x	x	
082 01 03 03	**Induced drag**						
LO	Explain the thrust-induced drag, the influence of the angle of attack and of the aspect ratio.			x	x	x	
082 01 03 04	**The airflow around a fuselage**						
LO	Describe the aircraft fuselage and the external components which cause drag, the airflow around the fuselage, influence of the pitch angle of the fuselage.			x	x	x	
LO	Define parasite drag as the sum of pressure drag and friction drag.			x	x	x	
LO	Define 'interference drag'.			x	x	x	
LO	Describe fuselage shapes that minimise drag.			x	x	x	
LO	Know the formula of the parasite drag and explain the influence of the speed.			x	x	x	
082 02 00 00	**TRANSONIC AERODYNAMICS and COMPRESSIBILITY EFFECTS**						
082 02 01 00	**Airflow speeds and velocities**						
082 02 01 01	**Speeds and Mach number**						
LO	Define the speed of sound in air.			x	x	x	

LO	State that the speed of sound is proportional to the square root of the absolute temperature (unit Kelvin).			x	x	x	
LO	Explain the variation of speed of sound with altitude.			x	x	x	
LO	Define Mach number.			x	x	x	
LO	Explain the meaning of incompressibility and compressibility of air; relate this to the value of Mach number.			x	x	x	
LO	Define subsonic, high subsonic and supersonic flows in relation to the value of the Mach number.			x	x	x	
082 02 01 02	**Shock waves**						
LO	Describe a shock wave in a supersonic flow and the pressure and speed changes by the shock.			x	x	x	
LO	Describe the appearance of local supersonic flows at the upper surface of a blade section and the compression by a shock when the section is in an upstream high subsonic flow.			x	x	x	
LO	Describe the effect of the shock on lift, drag, the pitching moment and the CL–CD ratio, drag divergence Mach number.			x	x	x	
082 02 01 03	**Influence of aerofoil section and blade planform**						
LO	Explain the different shapes which allow higher upstream Mach numbers without generating a shock wave on the upper surface: reducing the section thickness-to-chord ratio; special aerofoil sections as supercritical shapes; a planform with sweep angle, positive and negative.			x	x	x	
082 03 00 00	**ROTORCRAFT TYPES**						
082 03 01 00	**Rotorcraft**						
082 03 01 01	**Rotorcraft types**						
LO	Define the ‘autogyro’ and the ‘helicopter’.			x	x	x	

LO	Explain the rolling moment on an autogyro with fixed blades, the necessity to use flapping hinges and the ensuing reduction of the moment arm, the flapback of the blades.			x	x	x	
082 03 02 00	**Helicopters**						
082 03 02 01	**Helicopter configurations**						
LO	Describe the single main rotor helicopter and the other configurations: tandem, coaxial, side by side, synchrocopter (intermeshing blades), the compound helicopter, tilt-wing and tilt-rotor.			x	x	x	
082 03 02 02	**The helicopter, characteristics and associated terminology**						
LO	Describe the general layout of a single main rotor helicopter, fuselage, engine or engines, main gearbox, main rotor shaft and rotor hub.			x	x	x	
LO	Mention the tail rotor at the aft of the fuselage, the fenestron and the NOTOR (No Tail Rotor).			x	x	x	
LO	Define the rotor disc area and the blade area, the blades turning in the hubplane.			x	x	x	
LO	Describe the teetering rotor with the hinge axis on the shaft axis and the rotor with more than two blades with offset hinge axes.			x	x	x	
LO	Define the fuselage centre line and the three axes: roll, pitch and normal.			x	x	x	
LO	Define the gross weight and the gross mass (units), the disc and blade loading.			x	x	x	
082 04 00 00	**MAIN-ROTOR AERODYNAMICS**						
082 04 01 00	**Hover flight Outside Ground Effect (OGE)**						
082 04 01 01	**Airflow through the rotor disc and around the blades**						
LO	Define the circumferential (tangential) velocity of the blade sections, which equals the angular velocity of the rotor multiplied by the radius of the section.			x	x	x	
LO	Keep the blade fixed and define the undisturbed upstream air velocity relative to the blade.			x	x	x	

LO	Based on Newton's second law (momentum), explain that the vertical force on the disc, the rotor thrust, produces vertical downward velocities in the rotor-disc plane. The values of these thrust-induced velocities increase as the thrust increases and decrease with increasing rotor diameter. Know that the velocities some distance downstream are twice the value of the induced speed in the disc plane.			x	x	x	
LO	Explain why the production of the induced flow requires a power on the shaft, the induced power. The induced power is smallest if the induced velocities have the same value on the whole disc (flow uniformity over the disc).			x	x	x	
LO	Describe uniform and typical non-uniform velocities through the rotor disc.			x	x	x	
LO	Explain why the vertical rotor thrust must be somewhat higher than the weight because of the vertical drag on the fuselage.			x	x	x	
LO	Describe the vertical air velocities relative to the rotor disc as the sum of the upstream air velocities and the induced velocities.			x	x	x	
LO	Define the pitch angle and the angle of attack of a blade element.			x	x	x	
LO	Explain lift and the profile drag of a blade element.			x	x	x	
LO	Explain the resulting lift and the thrust on the blade, define the resulting rotor thrust.			x	x	x	
LO	Explain the necessity of collective pitch angle changes, the influence on the angles of attack and on the rotor thrust and the necessity of blade feathering.			x	x	x	
LO	Explain the blade twist necessary to obtain a more even induced airspeed over the disc.			x	x	x	
LO	Describe the different blade shapes (as viewed from above).			x	x	x	
LO	Explain how the profile drag on the blade elements generates a torque on the main shaft and define the resulting rotor profile power.			x	x	x	
LO	Explain the influence of air density on the required powers.			x	x	x	

LO	Show the effect on the airflow over the blade tips.			x	x	x	
082 04 01 02	**Anti-torque force and tail rotor**						
LO	Based on Newton's third law, explain the need of a tail-rotor thrust, the required value being proportional to the main-rotor torque. Show that the tail-rotor power is proportional to the tail-rotor thrust.			x	x	x	
LO	Explain the necessity of blade feathering of the tail-rotor blades and the control by the yaw pedals, the maximum and minimum values of the pitch angles of the blades.			x	x	x	
082 04 01 03	**Total power required and hover altitude Outside Ground Effect (OGE)**						
LO	Define the ancillary equipment and its power requirement.			x	x	x	
LO	Define the total power required.			x	x	x	
LO	Describe the influence of ambient pressure, temperature and moisture on the required power.			x	x	x	
082 04 02 00	**Vertical climb**						
082 04 02 01	**Relative airflow and angles of attack**						
LO	Describe the climb speed and the opposite vertical air velocity relative to the rotor disk.			x	x	x	
LO	Explain the relative air velocities and the angle of attack of the blade elements.			x	x	x	
LO	Explain how the angle of attack is controlled by the collective pitch angle control.			x	x	x	
082 04 02 02	**Power and vertical speed**						
LO	Define the total main-rotor power as the sum of the parasite power, the induced power, the climb power and the rotor profile power.			x	x	x	
LO	Explain why the total main-rotor power increases when the rate of climb increases.			x	x	x	
LO	Define the total required power in vertical flight.			x	x	x	
082 04 03 00	**Forward flight**						
082 04 03 01	**Airflow and forces in uniform inflow distribution**						

LO	Explain the assumption of a uniform inflow distribution on the rotor disc.			x	x	x	
LO	Define the azimuth angle of a blade, the advancing blade angular range centred at 90°, and the retreating blade range centred at 270°.			x	x	x	
LO	Show the upstream air velocities relative to the blade elements and the different effects on the advancing and retreating blade. Define the area of reverse flow. Explain the influence of forward speed on the tip circumferential speed.			x	x	x	
LO	Assuming constant pitch angles and rigid blade attachments, explain the huge roll moment by the asymmetric lift distribution.			x	x	x	
LO	Show that through cyclic feathering this imbalance could be eliminated by a low angle of attack (accomplished by a low-pitch angle) on the advancing blade and a high angle of attack (accomplished by a high-pitch angle) on the retreating blade.			x	x	x	
LO	Describe the high air velocity at the advancing blade tip and the compressibility effects which limit the maximum speed of the helicopter.			x	x	x	
LO	Describe the low air velocities on the retreating blade tip resulting from the circumferential speed and the forward speed, the necessity of high angle of attack and the onset of stall.			x	x	x	
LO	Define the tip–speed ratio and show the limits.			x	x	x	
LO	Explain the rotor thrust perpendicular to the rotor disc and the necessity to tilt the thrust vector forward. (Realisation will be explained in 082 05 00 00)			x	x	x	
LO	Explain the equilibrium conditions in steady straight and level flight.			x	x	x	
082 04 03 02	**The flare (powered flight)**						
LO	Explain the flare in powered flight, the rearward tilt of the rotor disc and of the thrust vector. Show the horizontal thrust component opposite to the speed.			x	x	x	
LO	State the increase of the thrust due to the upward inflow, and show the modifications of the angles of attack.			x	x	x	

LO	Explain the increase of rotor RPM in the case of a non-governed rotor.			x	x	x	
LO	Explain the actions to be taken by the pilot.			x	x	x	
082 04 03 03	**Non-uniform inflow distribution in relation to inflow roll**						
LO	Explain why the uniform inflow distribution is an assumption to simplify the theory and describe the real inflow distribution which modifies the angle of attack and the lift especially on the forward and backward blades.			x	x	x	
082 04 03 04	**Power and maximum speed**						
LO	Explain that the induced velocities and induced power decrease as the helicopter speed increases.			x	x	x	
LO	Define the profile drag and the profile power and their increase with helicopter speed.			x	x	x	
LO	Define the fuselage drag and the parasite power and the increase with helicopter speed.			x	x	x	
LO	Define the total drag and the increase with helicopter speed.			x	x	x	
LO	Describe the tail-rotor power and the power required by the ancillary equipment.			x	x	x	
LO	Define the total power requirement as a sum of the partial powers and explain how this total power varies with helicopter speed.			x	x	x	
LO	Explain the influence of the helicopter mass, the air density and additional external equipment on the partial powers and the total power required.			x	x	x	
LO	Describe the translational lift and show the decrease of required total power as the helicopter speed increases in the low-speed region.			x	x	x	
082 04 04 00	**Hover and forward flight In Ground Effect (IGE)**						
082 04 04 01	**Airflow in ground effect, downwash**						

LO	Explain how the vicinity of the ground changes the downward flow pattern and the consequences on lift (thrust) at constant rotor power. Show that the ground effect depends on the height of the rotor above the ground and the rotor diameter. Show the required rotor power at constant AUM as a function of height above the ground. Describe the influence of the forward speed.			x	x	x	
082 04 05 00	**Vertical descent**						
082 04 05 01	**Vertical descent, power on**						
LO	Describe the airflow to the rotor disc in a trouble-free vertical descent, power on, the airflow opposite to the helicopter velocity, the relative air velocity and the angle of attack.			x	x	x	
LO	Explain the vortex-ring state, the settling with power. State the approximate values of vertical descent speeds for the formation of vortex ring related to the values of the induced velocities.			x	x	x	
LO	Describe the airflow relative to the blades, the root stall, the loss of lift on the blade tip, the turbulence. Show the effect of raising the lever and discuss the effects on the controls.			x	x	x	
082 04 05 02	**Autorotation**						
LO	State the need for early recognition of malfunctions and for a quick initiation of recovery. Describe the recovery actions.			x	x	x	
LO	Explain that the collective lever position must be lowered sufficient quickly to avoid a rapid decay of rotor RPM, explain the influence of the rotational inertia of the rotor on the rate of decay.			x	x	x	
LO	Show the induced flow through the rotor disc, the rotational velocity and the relative airflow, the inflow and inflow angles.			x	x	x	
LO	Show how the aerodynamic forces on the blade elements vary from root to tip and distinguish three zones: the inner stalled ring (stall region), the middle autorotation ring (driving region), and the outer anti-autorotation ring (driven region). Explain the RPM stability at a given collective pitch.			x	x	x	
LO	Explain the control of the rotor RPM with collective pitch.			x	x	x	

LO	Show the need of negative tail-rotor thrust for yaw control.			x	x	x	
LO	Explain the final increase in rotor thrust by pulling the collective to decrease the vertical descent speed and the decay in rotor RPM.			x	x	x	
082 04 06 00	**Forward flight — Autorotation**						
082 04 06 01	**Airflow at the rotor disc**						
LO	Explain the factors affecting inflow angle and angle of attack, the autorotative power distribution and the asymmetry over the rotor disc in forward flight.			x	x	x	
082 04 06 02	**Flight and landing**						
LO	Show the effect of forward speed on the vertical descent speed.			x	x	x	
LO	Explain the effects of gross weight, rotor RPM and altitude (density) on endurance and range.			x	x	x	
LO	Explain the manoeuvers of turning and touchdown.			x	x	x	
LO	Explain the height–velocity avoidance graph or dead man's curves.			x	x	x	
082 05 00 00	**MAIN-ROTOR MECHANICS**						
082 05 01 00	**Flapping of the blade in hover**						
082 05 01 01	**Forces and stresses on the blade**						
LO	Show how the centrifugal forces depend on rotor RPM and blade mass and how they pull on the blade attachment to the hub. Apply the formula to an example. Justify the upper limit of the rotor RPM.			x	x	x	
LO	Assume a rigid attachment and show how thrust may cause huge oscillating bending moments which stress the attachment.			x	x	x	
LO	Explain why flapping hinges do not transfer such moments. Show the small flapping hinge offset on fully articulated rotors and zero offset in the case of teetering rotors.			x	x	x	
LO	Describe the working principle of the flexible element in the hingeless rotor and describe the equivalent flapping hinge offset compared to that of the articulated rotor.			x	x	x	
082 05 01 02	**Centrifugal turning moment**						

LO	Describe the centrifugal forces on the mass elements of a blade with pitch applied and the components of these forces. Show how these forces generate a moment which tries to reduce the blade-pitch angle.			x	x	x	
LO	Explain the methods of counteracting by hydraulics, bias springs and balance masses.			x	x	x	
082 05 01 03	**Coning angle in hover**						
LO	Show how the equilibrium of the moments about the flapping hinge of lift (thrust) and of the centrifugal force determine the coning angle of the blade (the blade weight being negligible).			x	x	x	
LO	Define the tip-path plane and the coning angle.			x	x	x	
LO	Explain the influence of rotor RPM and lift on the coning angle, justify the lower limit of the rotor RPM, relate the lift on one blade to the gross weight.			x	x	x	
LO	Explain the effect of the mass of the blade on the tip path and the tracking.			x	x	x	
082 05 02 00	**Flapping angles of the blade in forward flight**						
082 05 02 01	**Forces on the blade in forward flight without cyclic feathering**						
LO	Assume rigid attachments of the blade to the hub and show the periodic lift, moment and stresses on the attachment, the ensuing metal fatigue, the roll moment on the helicopter and justify the necessity for flapping hinge.			x	x	x	
LO	Assume no cyclic pitch and describe the lift on the advancing and the retreating blades.			x	x	x	
LO	State the azimuthal phase lag (90° or less) between the input (applied pitch) and the output (flapping angle). Explain the rotor flapback (the rearward tilting of the tip-path plane and the rotor thrust).			x	x	x	
082 05 02 02	**Cyclic pitch (feathering) in helicopter mode, forward flight**						
LO	Show that in order to assume and maintain forward flight, the rotor-thrust vector must get a forward component by tilting the tip-path plane.			x	x	x	

LO	Show how the applied cyclic pitch modifies the lift on the advancing and retreating blades and produces the required forward tilting of the tip-path plane and the rotor thrust.			x	x	x	
LO	Show the cone described by the blades and define the virtual axis of rotation (or the no flapping axis). Define the plane of rotation.			x	x	x	
LO	Define the reference system in which we define the movements: the shaft axis and the hub plane.			x	x	x	
LO	Describe the swash plates, the pitch link and the pitch horn. Explain how the collective lever moves the non-rotating swash plate up or down alongside the shaft axis.			x	x	x	
LO	Describe the mechanism by which the desired cyclic blade pitch can be produced by tilting the swash plate with the cyclic stick.			x	x	x	
LO	Define the no-feathering or control plane (control orbit) and the no-feathering axis or control axis.			x	x	x	
LO	Explain the translational lift effect when the speed increases.			x	x	x	
LO	Justify the increase of the tilt angle of the thrust vector and of the tip-path plane disc in order to increase the speed.			x	x	x	
082 05 03 00	**Blade-lag motion in forward flight**						
082 05 03 01	**Forces on the blade in the disc plane (tip-path plane) in forward flight**						
LO	Explain the Coriolis force due to flapping, the resulting periodic moments in the hub plane and the resulting periodic stresses which make lead-lag hinges necessary to avoid material fatigue.			x	x	x	
LO	Describe the profile-drag forces on the blade elements and the periodic variation of these forces.			x	x	x	
082 05 03 02	**The drag or lag hinge**						
LO	Describe the drag hinge of the fully articulated rotor and the lag flexure in the hingeless rotor.			x	x	x	
LO	Explain the necessity for drag dampers.			x	x	x	
082 05 03 03	**Ground resonance**						

LO	Explain the movement of the centre of gravity of the blades due to the lead-lag movements in the multiblade rotor.			x	x	x	
LO	Show the effect on the fuselage and the danger of resonance between this force and the fuselage and undercarriage. State the conditions likely to lead to ground resonance.			x	x	x	
082 05 04 00	**Rotor systems**						
082 05 04 01	**See-saw or teetering rotor**						
LO	Explain that a teetering rotor is prone to mast bumping in low G situations because of having no flapping hinge offset.			x	x	x	
082 05 04 02	**Fully articulated rotor**						
LO	Describe the fully articulated rotor with hinges and feathering bearings.			x	x	x	
LO	Describe ball and roller bearings and elastomeric bearings, advantages and disadvantages.			x	x	x	
082 05 04 03	**Hingeless rotor, bearingless rotor**						
LO	Show the forces on the flapping hinges with large offset (virtual hinge) and the resulting moments, compare them with other rotor systems.			x	x	x	
082 05 05 00	**Blade sailing**						
082 05 05 01	**Blade sailing and causes**						
LO	Define blade sailing, the influence of low rotor RPM and of headwind.			x	x	x	
082 05 05 02	**Minimising the danger**						
LO	Describe the actions to minimise danger and the demonstrated wind envelope for engaging and disengaging rotors.			x	x	x	
082 05 05 03	**Droop stops**						
LO	Explain the utility of the droop stops, retraction of the stops.			x	x	x	
082 05 06 00	**Vibrations due to main rotor**						
082 05 06 01	**Origins of the vertical vibrations**						

LO	Explain the lift (thrust) variations per revolution of a blade and the resulting vertical rotor-thrust variation in the case of perfect identical blades.			x	x	x	
LO	Show the resulting frequencies and amplitudes as a function of the number of blades.			x	x	x	
LO	Explain the thrust variation in case of an out-of-track blade, causes, frequencies (one-per-revolution).			x	x	x	
LO	Explain the importance of the hinges offset on the effect of the vibrations on the fuselage.			x	x	x	
082 05 06 02	**Lateral vibrations**						
LO	Explain imbalances of a blade, causes, and effects.			x	x	x	
LO	Explain the frequencies lateral one-per-revolution vibration.			x	x	x	
082 06 00 00	**TAIL ROTORS**						
082 06 01 00	**Conventional tail rotor**						
082 06 01 01	**Tail rotor description**						
LO	Describe the two-bladed rotor with teetering hinge, the rotors with more than two blades.			x	x	x	
LO	Show the flapping hinges and the feathering bearing.			x	x	x	
LO	Describe the dangers to ground personnel, to the rotor blades, possibilities of minimising these dangers.			x	x	x	
082 06 01 02	**Tail-rotor aerodynamics**						
LO	Explain the airflow around the blades in hover and in forward flight, the effects of the tip speeds on the noise production and the compressibility, limits.			x	x	x	
LO	Explain in hovering the effect of wind on the tail-rotor aerodynamics and thrust, problems.			x	x	x	
LO	Explain the tail-rotor thrust and the control through pitch control (feathering).			x	x	x	
LO	Explain the tail-rotor flapback, and the effects of delta-three hinges.			x	x	x	
LO	Describe roll moment and drift as side effects of the tail rotor.			x	x	x	

LO	Explain the effects of the tail-rotor failure.			x	x	x	
LO	Explain the loss of tail-rotor effectiveness, vortex-ring state, causes, crosswind and yaw speed.			x	x	x	
082 06 01 03	**Strakes on the tail boom**						
LO	Describe the strake and explain the function of the device.			x	x	x	
082 06 02 00	**The fenestron**						
082 06 02 01	**Technical layout**						
LO	Show the technical layout of a fenestron tail rotor.			x	x	x	
082 06 02 02	**Control concepts**						
LO	Explain the control concepts of a fenestron tail rotor.			x	x	x	
082 06 02 03	**Advantages and disadvantages**						
LO	Explain the advantages and disadvantages.			x	x	x	
082 06 03 00	**The NOTAR**						
082 06 03 01	**Technical layout**						
LO	Show the technical layout.			x	x	x	
082 06 03 02	**Control concepts**						
LO	Explain the control concepts.			x	x	x	
082 06 03 03	**Advantages and disadvantages**						
LO	Explain the advantages and disadvantages.			x	x	x	
082 06 04 00	**Vibrations**						
082 06 04 01	**Tail-rotor vibrations**						
LO	Explain the sources of vibration of the tail rotor and the resulting high frequencies.			x	x	x	
082 06 04 02	**Balancing and tracking**						
LO	Explain balancing and tracking of the tail rotor.			x	x	x	
082 07 00 00	**EQUILIBRIUM, STABILITY AND CONTROL**						
082 07 01 00	**Equilibrium and helicopter attitudes**						
082 07 01 01	**Hover**						
LO	Explain why the vector sum of forces and moments must be zero in any acceleration-free situation.			x	x	x	

LO	Indicate the forces and the moments about the lateral axis in a steady hover.			x	x	x	
LO	Indicate the forces and the moments about the longitudinal axis in a steady hover.			x	x	x	
LO	Deduce how the roll angle in a steady hover without wind results from the moments about the longitudinal axis.			x	x	x	
LO	Explain how the cyclic is used to create equilibrium of moments about the lateral axis in a steady hover.			x	x	x	
LO	Explain the consequence of the cyclic stick reaching its forward or aft limit during an attempt to take off to the hover.			x	x	x	
LO	Explain the influence of the density altitude on the equilibrium of forces and moments in a steady hover.			x	x	x	
082 07 01 02	**Forward flight**						
LO	Explain why the vector sum of forces and of moments must be zero in unaccelerated flight.			x	x	x	
LO	Indicate the forces and the moments about the lateral axis acting on a helicopter in a steady straight and level flight.			x	x	x	
LO	Explain the influence of All-Up Mass (AUM) on the forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain the influence of the position of the centre of gravity on the forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain the role of the cyclic stick position in creating equilibrium of forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain how forward speed influences the fuselage attitude.			x	x	x	
LO	Describe and explain the inflow roll effect.			x	x	x	
082 07 02 00	**Stability**						
082 07 02 01	**Static longitudinal, roll and directional stability**						
LO	Define static stability; give an example of static stability and of static instability.			x	x	x	
LO	Explain the contribution of the main rotor to speed stability.			x	x	x	

LO	Describe the influence of the horizontal stabiliser on static longitudinal stability.			x	x	x	
LO	Explain the effect of hinge offset on static stability.			x	x	x	
LO	Describe the influence of the tail rotor on static directional stability.			x	x	x	
LO	Describe the influence of the vertical stabiliser on static directional stability.			x	x	x	
LO	Explain the influence of the main rotor on the static roll stability.			x	x	x	
LO	Describe the influence of the longitudinal position of the centre of gravity on the static longitudinal stability.			x	x	x	
082 07 02 02	**Static stability in the hover**						
LO	Describe the initial movements of a hovering helicopter after the occurrence of a horizontal gust.			x	x	x	
082 07 02 03	**Dynamic stability**						
LO	Define dynamic stability; give an example of dynamic stability and of dynamic instability.			x	x	x	
LO	Explain why static stability is a precondition for dynamic stability.			x	x	x	
082 07 02 04	**Longitudinal stability**						
LO	Explain the individual contributions of angle of attack and speed stability together with the stabiliser and fuselage on the dynamic longitudinal stability.			x	x	x	
LO	Explain the principle of stability-augmentation systems.			x	x	x	
LO	Define the characteristics of a phugoid.			x	x	x	
082 07 02 05	**Roll stability and directional stability**						
LO	Explain the effect of a dihedral on a helicopter.			x	x	x	
LO	Describe how a dihedral influences the static roll stability.			x	x	x	
LO	Know that a large static roll stability together with a small directional stability may lead to a Dutch roll.			x	x	x	
LO	Explain which stability features taken together may result in spiral dive and the reason why.			x	x	x	

LO	Explain the static directional stability features of a tandem rotor type helicopter.			x	x	x	
082 07 03 00	**Control**						
082 07 03 01	**Manoeuver stability**						
LO	Define the meaning of stick-force stability.			x	x	x	
LO	Define the meaning of stick-position stability.			x	x	x	
LO	Explain the meaning of the stick-force diagram and trim speed.			x	x	x	
LO	Explain the meaning of stick force per G.			x	x	x	
LO	Explain how a bob weight influences stick force per G.			x	x	x	
LO	Explain how helicopter control can be limited because of available stick travel.			x	x	x	
LO	Explain how the position of the centre of gravity influences the remaining stick travel.			x	x	x	
082 07 03 02	**Control power**						
LO	Explain the meaning of the control moment.			x	x	x	
LO	Explain the importance of the centre of gravity position on the control moment.			x	x	x	
LO	Explain how the changes of magnitude of rotor thrust of a helicopter during manoeuvres influence the control moment.			x	x	x	
LO	Explain which control moment provides control for a helicopter rotor with zero-hinge offset (central flapping hinge).			x	x	x	
LO	Explain the different type of rotor control moments which together provide the control of helicopters with a hingeless or a fully articulated rotor system.			x	x	x	
LO	Explain the influence of hinge offset on controllability.			x	x	x	
082 07 03 03	**Static and dynamic rollover**						
LO	Explain the mechanism which causes dynamic rollover.			x	x	x	
LO	Explain the required pilot action when dynamic rollover is starting to develop.			x	x	x	
082 08 00 00	**HELICOPTER FLIGHT MECHANICS**						
082 08 01 00	**Flight limits**						

082 08 01 01	**Hover and vertical flight**						
LO	Show the power required OGE and IGE and the power available, the OGE and IGE maximum hover height (see subject 020, piston engines and turbine engines).			x	x	x	
LO	Explain the effects of All-Up Mass (AUM), ambient temperature and pressure, density altitude and moisture.			x	x	x	
LO	Discuss the rate of climb in a vertical flight.			x	x	x	
082 08 01 02	**Forward flight**						
LO	Compare the power required and the power available as a function of speed in straight and level flight.			x	x	x	
LO	Define the maximum speed limited by power and the value relative to VNE and VNO.			x	x	x	
LO	Use the graph to determine the speeds of maximum rate of climb and the maximum angle of climb.			x	x	x	
LO	Use the graph to define the TAS for maximum range and maximum endurance, consider the case of the piston engine and the turbine engine. Explain the effects of tailwind or headwind on the speed for maximum range.			x	x	x	
LO	Explain the effects of AUM, pressure and temperature, density altitude, humidity.			x	x	x	
082 08 01 03	**Manoeuvring**						
LO	Define the load factor, the radius of turn and the rate of turn.			x	x	x	
LO	Explain the relationship between the bank angle, the airspeed and the radius of turn, between the bank angle and the load factor.			x	x	x	
LO	Explain the influence of All-Up Mass (AUM), pressure and temperature, density altitude, humidity.			x	x	x	
LO	Define the limit-load factors and the certification categories.			x	x	x	
082 08 02 00	**Special conditions**						
082 08 02 01	**Operating with limited power**						

LO	Explain the operations with limited power, use the graph to show the limitations on vertical flight and level flight, discuss the power checks and procedures for take-off and landing.			x	x	x	
LO	Describe manoeuvres with limited power.			x	x	x	
082 08 02 02	**Overpitch, overtorque**						
LO	Describe overpitching and show the consequences.			x	x	x	
LO	Describe situations likely to lead to overpitching.			x	x	x	
LO	Describe overtorqueing and show the consequences.			x	x	x	
LO	Describe situations likely to lead to overtorqueing.			x	x	x	

O. SUBJECT 091 — VFR COMMUNICATIONS

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
090 00 00 00	**COMMUNICATIONS**						
091 00 00 00	**VFR COMMUNICATIONS**						
091 01 00 00	**DEFINITIONS**						
091 01 01 00	**Meanings and significance of associated terms**						
LO	Stations.	x	x	x	x	x	
LO	Communication methods.	x	x	x	x	x	
091 01 02 00	**Air Traffic Services abbreviations**						
LO	Define commonly used Air Traffic Control abbreviations: flight conditions; airspace; services; time; miscellaneous.	x	x	x	x	x	
091 01 03 00	**Q-code groups commonly used in RTF air–ground communications**						

LO	Define Q-code groups commonly used in RTF air-to-ground communications: pressure settings; directions and bearings.	x	x	x	x	x	
LO	State the procedure for obtaining bearing information in flight.	x	x	x	x	x	
091 01 04 00	**Categories of messages**						
LO	List the categories of messages in order of priority.	x	x	x	x	x	
LO	Identify the types of messages appropriate to each category.	x	x	x	x	x	
LO	List the priority of a message (from given examples of messages to compare).	x	x	x	x	x	
091 02 00 00	**GENERAL OPERATING PROCEDURES**						
091 02 01 00	**Transmission of letters**						
LO	State the phonetic alphabet used in radio-telephony.	x	x	x	x	x	
LO	Identify the occasions when words should be spelt.	x	x	x	x	x	
091 02 02 00	**Transmission of numbers (including level information)**						
LO	Describe the method of transmission of numbers: pronunciation; single digits, whole hundreds and whole thousands.	x	x	x	x	x	
091 02 03 00	**Transmission of time**						
LO	Describe the ways of transmitting time: standard time reference (UTC); minutes, minutes and hours, when required.	x	x	x	x	x	
091 02 04 00	**Transmission technique**						
LO	Explain the techniques used for making good R/T transmissions.	x	x	x	x	x	
091 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**						
LO	Define the meaning of ‘standard words and phrases’.	x	x	x	x	x	
LO	Use correct phraseology for each phase of VFR flight.	x	x	x	x	x	

LO	Aerodrome procedures: departure information; taxiing instructions; aerodrome traffic and circuits; final approach and landing; after landing; essential aerodrome information.	x	x	x	x	x	
LO	VFR departure.	x	x	x	x	x	
LO	VFR arrival.	x	x	x	x	x	
091 02 06 00	**Radio-telephony call signs for aeronautical stations including use of abbreviated call signs**						
LO	Name the two parts of the call sign of an aeronautical station.	x	x	x	x	x	
LO	Identify the call-sign suffixes for aeronautical stations.	x	x	x	x	x	
LO	Explain when the call sign may be omitted or abbreviated to the use of suffix only.	x	x	x	x	x	
091 02 07 00	**Radio-telephony call signs for aircraft including use of abbreviated call signs**						
LO	List the three different ways to compose an aircraft call sign.	x	x	x	x	x	
LO	Describe the abbreviated forms for aircraft call signs.	x	x	x	x	x	
LO	Explain when aircraft call signs may be abbreviated.	x	x	x	x	x	
091 02 08 00	**Transfer of communication**						
LO	Describe the procedure for transfer of communication: by ground station; by aircraft.	x	x	x	x	x	
091 02 09 00	**Test procedures including readability scale**						
LO	Explain how to test radio transmission and reception.	x	x	x	x	x	
LO	State the readability scale and explain its meaning.	x	x	x	x	x	
091 02 10 00	**Read-back and acknowledgement requirements**						
LO	State the requirement to read back ATC route clearances.	x	x	x	x	x	
LO	State the requirement to read back clearances related to the runway in use.	x	x	x	x	x	

LO	State the requirement to read back other clearances including conditional clearances.	x	x	x	x	x	
LO	State the requirement to read back other data such as runway, SSR codes, etc.	x	x	x	x	x	
091 02 11 00	**Radar procedural phraseology**						
LO	Use the correct phraseology for an aircraft receiving a radar service: radar identification; radar vectoring; traffic information and avoidance; SSR procedures.	x	x	x	x	x	
091 03 00 00	**RELEVANT WEATHER INFORMATION TERMS (VFR)**						
091 03 01 00	**Aerodrome weather**						
LO	List the contents of aerodrome weather reports and state units of measurement used for each item: wind direction and speed; variation of wind direction and speed; visibility; present weather; cloud amount and type (including the meaning of CAVOK); air temperature and dew point; pressure values (QNH, QFE); supplementary information (aerodrome warnings, landing runway, runway conditions, restrictions, obstructions, wind-shear warnings, etc.).	x	x	x	x	x	
091 03 02 00	**Weather broadcast**						
LO	List the sources of weather information available for aircraft in flight.	x	x	x	x	x	
LO	Explain the meaning of the acronyms ‘ATIS’, ‘VOLMET’.	x	x	x	x	x	
091 04 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**						
LO	State the action to be taken in case of communication failure on a controlled VFR flight.	x	x	x	x	x	
LO	Identify the frequencies to be used in an attempt to establish communication.	x	x	x	x	x	
LO	State the additional information that should be transmitted in the event of receiver failure.	x	x	x	x	x	

LO	Identify the SSR code that may be used to indicate communication failure.	x	x	x	x	x	
LO	Explain the action to be taken by a pilot with communication failure in the aerodrome traffic pattern at controlled aerodromes.	x	x	x	x	x	
091 05 00 00	**DISTRESS AND URGENCY PROCEDURES**						
091 05 01 00	**Distress (definition, frequencies, watch of distress frequencies, distress signal, distress message)**						
LO	State the DISTRESS procedures.	x	x	x	x	x	
LO	Define DISTRESS.	x	x	x	x	x	
LO	Identify the frequencies that should be used by aircraft in DISTRESS.	x	x	x	x	x	
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	x	x	x	x	x	
LO	Describe the action to be taken by the station which receives a DISTRESS message.	x	x	x	x	x	
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x	x	x	x	x	
LO	List the content of a DISTRESS signal/message in the correct sequence.	x	x	x	x	x	
091 05 02 00	**Urgency (definition, frequencies, urgency signal, urgency message)**						
LO	State the URGENCY procedures.	x	x	x	x	x	
LO	Define URGENCY.	x	x	x	x	x	
LO	Identify the frequencies that should be used by aircraft in URGENCY.	x	x	x	x	x	
LO	Describe the action to be taken by the station which receives an URGENCY message.	x	x	x	x	x	
LO	Describe the action to be taken by all other stations when an URGENCY procedure is in progress.	x	x	x	x	x	
LO	List the content of an URGENCY signal/message in the correct sequence.	x	x	x	x	x	
091 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**						
LO	Describe the radio-frequency spectrum with particular reference to VHF.	x	x	x	x	x	

LO	Describe the radio-frequency spectrum of the bands into which the radio-frequency spectrum is divided.	x	x	x	x	x	
LO	Identify the frequency range of the VHF band.	x	x	x	x	x	
LO	Name the band normally used for Aeronautical Mobile Service voice communication.	x	x	x	x	x	
LO	State the frequency separation allocated between consecutive VHF frequencies.	x	x	x	x	x	
LO	Describe the propagation characteristics of radio transmissions in the VHF band.	x	x	x	x	x	
LO	Describe the factors which reduce the effective range and quality of radio transmissions.	x	x	x	x	x	
LO	State which of these factors apply to the VHF band.	x	x	x	x	x	
LO	Calculate the effective range of VHF transmissions assuming no attenuating factors.	x	x	x	x	x	

P. SUBJECT 092 — IFR COMMUNICATIONS

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
090 00 00 00	**COMMUNICATIONS**						
092 00 00 00	**IFR COMMUNICATIONS**						
092 01 00 00	**DEFINITIONS**						
092 01 01 00	**Meanings and significance of associated terms**						
LO	Stations.	x		x			x
LO	Communication methods.	x		x			x
LO	The terms used in conjunction with the approach and holding procedures.	x		x			x
092 01 02 00	**Air Traffic Control abbreviations**						
LO	Define commonly used Air Traffic Control abbreviations: flight conditions; airspace; services; time; miscellaneous.	x		x			x

LO	The additional IFR-related terms.	x		x			x
092 01 03 00	**Q-code groups commonly used in RTF air–ground communications**						
LO	Define Q-code groups commonly used in RTF air-to-ground communications: pressure settings; directions and bearings.	x		x			x
LO	State the procedure for obtaining a bearing information in flight.	x		x			x
092 01 04 00	**Categories of messages**						
LO	List the categories of messages in order of priority.	x		x			x
LO	Identify the types of messages appropriate to each category.	x		x			x
LO	List the priority of a message (given examples of messages to compare).	x		x			x
092 02 00 00	**GENERAL OPERATING PROCEDURES**						
092 02 01 00	**Transmission of letters**						
LO	State the phonetic alphabet used in radio-telephony.	x		x			x
LO	Identify the occasions when words should be spelt.	x		x			x
092 02 02 00	**Transmission of numbers (including level information)**						
LO	Describe the method of transmitting numbers: pronunciation; single digits, whole hundreds and whole thousands.	x		x			x
092 02 03 00	**Transmission of time**						
LO	Describe the ways of transmitting time: standard time reference (UTC); minutes, minutes and hours, when required.	x		x			x
092 02 04 00	**Transmission technique**						
LO	Explain the techniques used for making good R/T transmissions.	x		x			x
092 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**						
LO	Define the meaning of 'standard words and phrases'.	x		x			x

LO	Use correct standard phraseology for each phase of IFR flight: pushback; IFR departure; airways clearances; position reporting; approach procedures; IFR arrivals.	x		x			x
092 02 06 00	**Radio-telephony call signs for aeronautical stations including use of abbreviated call signs**						
LO	Name the two parts of the call sign of an aeronautical station.	x		x			x
LO	Identify the call-sign suffixes for aeronautical stations.	x		x			x
LO	Explain when the call sign may be omitted or abbreviated to the use of suffix only.	x		x			x
LO	Name the two parts of the call sign of an aeronautical station.	x		x			x
LO	Identify the call-sign suffixes for aeronautical stations.	x		x			x
LO	Explain when the call sign may be abbreviated to the use of suffix only.	x		x			x
092 02 07 00	**Radio-telephony call signs for aircraft including use of abbreviated call signs**						
LO	List the three different ways to compose an aircraft call sign.	x		x			x
LO	Describe the abbreviated forms for aircraft call signs.	x		x			x
LO	Explain when aircraft call signs may be abbreviated.	x		x			x
LO	Explain when the suffix 'HEAVY' should be used with an aircraft call sign.	x		x			x
LO	Explain the use of the phrase 'Change your call sign to…'.	x		x			x
LO	Explain the use of the phrase 'Revert to flight plan call sign'.	x		x			x
092 02 08 00	**Transfer of communication**						
LO	Describe the procedure for transfer of communication: by ground station; by aircraft.	x		x			x

092 02 09 00	**Test procedures including readability scale; establishment of RTF communication**						
LO	Explain how to test radio transmission and reception.	x		x			x
LO	State the readability scale and explain its meaning.	x		x			x
092 02 10 00	**Read-back and acknowledgement requirements**						
LO	State the requirement to read back ATC route clearances.	x		x			x
LO	State the requirement to read back clearances related to runway in use.	x		x			x
LO	State the requirement to read back other clearances including conditional clearances.	x		x			x
LO	State the requirement to read back data such as runway, SSR codes, etc.	x		x			x
092 02 11 00	**Radar procedural phraseology**						
LO	Use the correct phraseology for an aircraft receiving a radar service: radar identification; radar vectoring; traffic information and avoidance; SSR procedures.	x		x			x
092 02 12 00	**Level changes and reports**						
LO	Use the correct term to describe vertical position: in relation to flight level (standard pressure setting); in relation to altitude (metres/feet on QNH); in relation to height (metres/feet on QFE).	x		x			x
092 03 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**						
LO	Describe the action to be taken in communication failure on an IFR flight.	x		x			x
LO	Describe the action to be taken in case of communication failure on an IFR flight when flying in VMC and the flight will be terminated in VMC.	x		x			x
LO	Describe the action to be taken in case of communication failure on an IFR flight when flying in IMC.	x		x			x
092 04 00 00	**DISTRESS AND URGENCY PROCEDURES**						
092 04 01 00	**PAN MEDICAL**						

LO	Describe the type of flights to which PAN MEDICAL applies.	x		x			x
LO	List the content of a PAN MEDICAL message in correct sequence.	x		x			x
092 04 02 00	**Distress (definition, frequencies, watch of distress frequencies, distress signal, distress message)**						
LO	State the DISTRESS procedures.	x		x			x
LO	Define DISTRESS.	x		x			x
LO	Identify the frequencies that should be used by aircraft in DISTRESS.	x		x			x
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	x		x			x
LO	Describe the action to be taken by the station which receives a DISTRESS message.	x		x			x
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x		x			x
LO	List the content of a DISTRESS message.	x		x			x
092 04 03 00	**Urgency (definition, frequencies, urgency signal, urgency message)**						
LO	State the URGENCY procedures.	x		x			x
LO	Define URGENCY.	x		x			x
LO	Identify the frequencies that should be used by aircraft in URGENCY.	x		x			x
LO	Describe the action to be taken by the station which receives an URGENCY message.	x		x			x
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x		x			x
LO	List the content of an URGENCY signal/message in the correct sequence.	x		x			x
092 05 00 00	**RELEVANT WEATHER INFORMATION TERM**						
092 05 01 00	**Aerodrome weather**						

LO	List the contents of aerodrome weather reports and state units of measurement used for each item: wind direction and speed; variation of wind direction and speed; visibility; present weather; cloud amount and type (including the meaning of CAVOK); air temperature and dew point; pressure values (QNH, QFE); supplementary information (aerodrome warnings, landing runway, runway conditions, restrictions, obstructions, wind-shear warnings, etc.).	x		x			x
LO	State units for measurement used for runway visual range.	x		x			x
LO	State units of measurement used for braking action (friction coefficient).	x		x			x
092 05 02 00	**Weather broadcast**						
LO	List the sources of weather information available for aircraft in flight.	x		x			x
LO	Explain the meaning of the acronyms 'ATIS', 'VOLMET'.	x		x			x
LO	Explain when aircraft routine meteorological observations should be made.	x		x			x
LO	Explain when aircraft special meteorological observations should be made.	x		x			x
092 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**						
LO	Describe the radio-frequency spectrum with particular reference to VHF.	x		x			x
LO	State the names of the bands into which the radio-frequency spectrum is divided.	x		x			x
LO	Identify the frequency range of the VHF band.	x		x			x
LO	Name the band normally used for Aeronautical Mobile Service voice communications.	x		x			x
LO	State the frequency separation allocated between consecutive VHF frequencies.	x		x			x
LO	Describe the propagation characteristics of radio transmissions in the VHF band.	x		x			x
LO	Describe the factors which reduce the effective range and quality of radio transmissions.	x		x			x
LO	State which of these factors apply to the VHF band.	x		x			x

LO	Calculate the effective range of VHF transmissions assuming no attenuating factors.	x		x			x
092 07 00 00	**MORSE CODE**						
LO	Identify radio-navigation aids (VOR, DME, NDB, ILS) from their Morse-code identifiers.	x	x	x	x	x	x
LO	SELCAL, TCAS, ACARS phraseology and procedures.	x	x	x	x	x	x

(b) Airship

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CPL AND IR

The applicable items for each licence or rating are marked with 'x'. An 'x' on the main title of a subject means that all the subdivisions are applicable.'

FCL.315 CPL — Training course

An applicant for a CPL shall have completed theoretical knowledge instruction and flight instruction at an ATO, in accordance with Appendix 3 to this Part.

FCL.320 CPL — Skill test

An applicant for a CPL shall pass a skill test in accordance with Appendix 4 to this Part to demonstrate the ability to perform, as PIC of the appropriate aircraft category, the relevant procedures and manoeuvres with the competency appropriate to the privileges granted.

SECTION 2 - Specific requirements for the aeroplane category — CPL(A)

FCL.315.A CPL — Training course

Theoretical knowledge and flight instruction for the issue of a CPL(A) shall include upset prevention and recovery training.

FCL.325.A CPL(A) — Specific conditions for MPL holders

Before exercising the privileges of a CPL(A), the holder of an MPL shall have completed in aeroplanes:

(a) 70 hours of flight time:

(1) as PIC; or

(2) made up of at least 10 hours as PIC and the additional flight time as PIC under supervision (PICUS).

Of these 70 hours, 20 shall be of VFR cross-country flight time as PIC, or cross-country flight time made up of at least 10 hours as PIC and 10 hours as PICUS. This shall include a VFR cross-country flight of at least 540 km (300 NM) in the course of which full-stop landings at two different aerodromes shall be flown as PIC;

(b) the elements of the CPL(A) modular course as specified in paragraphs 10(a) and 11 of Appendix 3, E to this Part; and

(c) the CPL(A) skill test, in accordance with FCL.320.

SUBPART E - MULTI-CREW PILOT LICENCE — MPL

FCL.400.A MPL — Minimum age

An applicant for an MPL shall be at least 18 years of age.

FCL.405.A MPL — Privileges

(a) The privileges of the holder of an MPL are to act as co-pilot in an aeroplane required to be operated with a co-pilot.

(b) The holder of an MPL may obtain the extra privileges of:

(1) the holder of a PPL(A), provided that the requirements for the PPL(A) specified in Subpart C are met;

(2) a CPL(A), provided that the requirements specified in FCL.325.A are met.

(c) The holder of an MPL shall have the privileges of his/her IR(A) limited to aeroplanes required to be operated with a co-pilot. The privileges of the IR(A) may be extended to single-pilot operations in aeroplanes, provided that the licence holder has completed the training necessary to act as PIC in single-pilot operations exercised solely by reference to instruments and passed the skill test of the IR(A) as a single-pilot.

FCL.410.A MPL — Training course and theoretical knowledge examinations

(a) Course. An applicant for an MPL shall have completed a training course of theoretical knowledge and flight instruction at an ATO in accordance with Appendix 5 to this Part. Theoretical knowledge and flight instruction for the issue of an MPL shall include upset prevention and recovery training.

(b) Examination. An applicant for an MPL shall have demonstrated a level of knowledge appropriate to the holder of an ATPL(A), in accordance with FCL.515, and of a multi-pilot type rating.

FCL.415.A MPL — Practical skill

(a) An applicant for an MPL shall have demonstrated through continuous assessment the skills required for fulfilling all the competency units specified in Appendix 5 to this Part, as pilot flying and pilot not flying, in a multi-engine turbine-powered multi-pilot aeroplane, under VFR and IFR.

(b) On completion of the training course, the applicant shall pass a skill test in accordance with Appendix 9 to this Part, to demonstrate the ability to perform the relevant procedures and manoeuvres with the competency appropriate to the privileges granted. The skill test shall be taken in the type of aeroplane used on the advanced phase of the MPL integrated training course or in an FFS representing the same type.

SUBPART F - AIRLINE TRANSPORT PILOT LICENCE — ATPL

SECTION 1 - Common requirements

FCL.500 ATPL — Minimum age

Applicants for an ATPL shall be at least 21 years of age.

FCL.505 ATPL — Privileges

(a) The privileges of the holder of an ATPL are, within the appropriate aircraft category, to:

(1) exercise all the privileges of the holder of an LAPL, a PPL and a CPL;

(2) act as PIC of aircraft engaged in commercial air transport.

(b) Applicants for the issue of an ATPL shall have fulfilled the requirements for the type rating of the aircraft used in the skill test.

FCL.515 ATPL — Training course and theoretical knowledge examinations

(a) Course. Applicants for an ATPL shall have completed a training course at an ATO. The course shall be either an integrated training course or a modular course, in accordance with Appendix 3 to this Part.

(b) Examination. Applicants for an ATPL shall demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

— Air Law,

— Aircraft General Knowledge — Airframe/Systems/Power plant,

— Aircraft General Knowledge — Instrumentation,

— Mass and Balance,

— Performance,

— Flight Planning and Monitoring,

— Human Performance,

— Meteorology,

— General Navigation,

— Radio Navigation,

— Operational Procedures,

— Principles of Flight,

— VFR Communications,

— IFR Communications.

AMC1 FCL.310; FCL.515 (b); FCL.615 (b)

SECTION 2 - Specific requirements for the aeroplane category — ATPL(A)

FCL.505.A ATPL(A) — Restriction of privileges for pilots previously holding an MPL

When the holder of an ATPL(A) has previously held only an MPL, the privileges of the licence shall be restricted to multi-pilot operations, unless the holder has complied with FCL.405.A(b)(2) and (c) for single-pilot operations.

FCL.510.A ATPL(A) — Prerequisites, experience and crediting

(a) Prerequisites. Applicants for an ATPL(A) shall hold:

(1) an MPL; or

(2) a CPL(A) and a multi-engine IR for aeroplanes. In this case, the applicant shall also have received instruction in MCC.

(b) Experience. Applicants for an ATPL(A) shall have completed a minimum of 1 500 hours of flight time in aeroplanes, including at least:

(1) 500 hours in multi-pilot operations on aeroplanes;

(2)

(i) 500 hours as PIC under supervision; or

(ii) 250 hours as PIC; or

(iii) 250 hours, including at least 70 hours as PIC, and the remaining as PIC under supervision;

(3) 200 hours of cross-country flight time of which at least 100 hours shall be as PIC or as PIC under supervision;

(4) 75 hours of instrument time of which not more than 30 hours may be instrument ground time; and

(5) 100 hours of night flight as PIC or co-pilot.

Of the 1 500 hours of flight time, up to 100 hours of flight time may have been completed in an FFS and FNPT. Of these 100 hours, only a maximum of 25 hours may be completed in an FNPT.

(c) Crediting.

(1) Holders of a pilot licence for other categories of aircraft shall be credited with flight time up to a maximum of:

(i) for TMG or sailplanes, 30 hours flown as PIC;

(ii) for helicopters, 50 % of all the flight time requirements of paragraph (b).

(2) Holders of a flight engineer licence issued in accordance with applicable national rules shall be credited with 50 % of the flight engineer time up to a maximum credit of 250 hours.

These 250 hours may be credited against the 1 500 hours requirement of paragraph (b), and the 500 hours requirement of paragraph (b)(1), provided that the total credit given against any of these paragraphs does not exceed 250 hours.

(d) The experience required in (b) shall be completed before the skill test for the ATPL(A) is taken.

AMC1 FCL.510.A (b)(1) ATPL(A) — Prerequisites, experience and crediting

Equivalent requirements for CS-25 and CS-23 commuter category are the JAR/FAR-25 transport category, JAR/FAR-23 commuter category, or BCAR or AIR 2051.

FCL.520.A ATPL(A) — Skill test

Applicants for an ATPL(A) shall pass a skill test in accordance with Appendix 9 to this Part to demonstrate the ability to perform, as PIC of a multi-pilot aeroplane under IFR, the relevant procedures and manoeuvres with the competency appropriate to the privileges granted.

The skill test shall be taken in the aeroplane or an adequately qualified FFS representing the same type.

AMC1 FCL.520.A; FCL.520.H

ATPL SKILL TEST

The ATPL skill test may serve at the same time as a skill test for the issue of the licence and a proficiency check for the revalidation of the type rating for the aircraft used in the test and may be combined with the skill test for the issue of a MP type rating.

SECTION 3 - Specific requirements for the helicopter category — ATPL(H)

FCL.510.H ATPL(H) — Prerequisites, experience and crediting

Applicants for an ATPL(H) shall:

(a) hold a CPL(H) and a multi-pilot helicopter type rating and have received instruction in MCC;

(b) have completed as a pilot of helicopters a minimum of 1 000 hours of flight time including at least:

(1) 350 hours in multi-pilot helicopters;

(2)

(i) 250 hours as PIC; or

(ii) 100 hours as PIC and 150 hours as PIC under supervision; or

(iii) 250 hours as PIC under supervision in multi-pilot helicopters. In this case, the ATPL(H) privileges shall be limited to multi-pilot operations only, until 100 hours as PIC have been completed;

(3) 200 hours of cross-country flight time of which at least 100 hours shall be as PIC or as PIC under supervision;

(4) 30 hours of instrument time of which not more than 10 hours may be instrument ground time; and

(5) 100 hours of night flight as PIC or as co-pilot.

Of the 1 000 hours, a maximum of 100 hours may have been completed in an FSTD, of which not more than 25 hours may be completed in an FNPT.

(c) Flight time in aeroplanes shall be credited up to 50 % against the flight time requirements of paragraph (b).

(d) The experience required in (b) shall be completed before the skill test for the ATPL(H) is taken.

FCL.520.H ATPL(H) — Skill test

Applicants for an ATPL(H) shall pass a skill test in accordance with Appendix 9 to this Part to demonstrate the ability to perform as PIC of a multi-pilot helicopter the relevant procedures and manoeuvres with the competency appropriate to the privileges granted.

The skill test shall be taken in the helicopter or an adequately qualified FFS representing the same type.

AMC1 FCL.520.A; FCL.520.H

SUBPART G - INSTRUMENT RATING — IR

SECTION 1 - Common requirements

FCL.600 IR — General

Except as provided in FCL.825, operations under IFR on an aeroplane, helicopter, airship or powered-lift aircraft shall only be conducted by holders of:

(a) a PPL, CPL, MPL and ATPL, and

(b) except when undergoing skill tests, proficiency checks or when receiving dual instruction, an IR with privileges appropriate to the applicable airspace requirements and to the category of aircraft.

FCL.605 IR — Privileges

(a) The privileges of a holder of an IR are to fly aircraft under IFR, including PBN operations, with a minimum decision height of no less than 200 feet (60 m)

(b) In the case of a multi-engine IR, these privileges may be extended to decision heights lower than 200 feet (60 m) when the applicant has undergone specific training at an ATO and has passed section 6 of the skill test prescribed in Appendix 9 to this Part in multi-pilot aircraft.

(c) Holders of an IR shall exercise their privileges in accordance with the conditions established in Appendix 8 to this Part.

(d) Helicopters only. To exercise privileges as PIC under IFR in multi-pilot helicopters, the holder of an IR(H) shall have at least 70 hours of instrument time of which up to 30 hours may be instrument ground time.

FCL.610 IR — Prerequisites and crediting

Applicants for an IR shall:

(a) hold:

(1) at least a PPL in the appropriate aircraft category, and:

(i) the privileges to fly at night in accordance with FCL.810, if the IR privileges will be used at night; or

(ii) an ATPL in another category of aircraft; or

(2) a CPL, in the appropriate aircraft category;

(b) have completed at least 50 hours of cross-country flight time as PIC in aeroplanes, TMGs, helicopters or airships, of which at least 10 or, in the case of airships, 20 hours shall be in the relevant aircraft category;

(c) Helicopters only. Applicants who have completed an ATP(H)/IR, ATP(H), CPL(H)/IR or CPL(H) integrated training course shall be exempted from the requirement in (b).

FCL.615 IR — Theoretical knowledge and flight instruction

(a) Course. Applicants for an IR shall have received a course of theoretical knowledge and flight instruction at an ATO. The course shall be:

(1) an integrated training course which includes training for the IR, in accordance with Appendix 3 to this Part; or

(2) a modular course in accordance with Appendix 6 to this Part.

(b) Examination. Applicants shall demonstrate a level of theoretical knowledge appropriate to the privileges granted in the following subjects:

— Air Law,

— Aircraft General Knowledge - Instrumentation,

— Flight Planning and Monitoring,

— Human Performance,

— Meteorology,

— Radio Navigation,

— IFR Communications.

AMC1 FCL.310; FCL.515 (b); FCL.615 (b)

AMC1 FCL.615(b) IR – Theoretical knowledge and flight instruction

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE IR FOLLOWING THE COMPETENCY-BASED MODULAR COURSE AND EIR

(a) The following tables contain the detailed theoretical knowledge syllabus for the IR following the competency-based modular route (IR(A)) and the EIR.
(b) Aspects related to non-technical skills should be included in an integrated manner, taking into account the particular risks associated to the licence and the activity.
(c) The applicant who has completed a modular IR(A) course according to Appendix 6 A and passed the IR(A) theoretical knowledge examination should be fully credited towards the requirements of theoretical knowledge instruction and examination for a competency-based IR(A) or EIR within the validity period of the examination. An applicant wishing to transfer to a competency-based IR(A) or EIR course during a modular IR(A) course should be credited towards the requirements of theoretical knowledge instruction and examination for a competency-based IR(A) or EIR for those subjects or theory items already completed.
(d) The applicant for an IR(A) who has completed an EIR theoretical knowledge course and passed the EIR theoretical knowledge examination according to FCL.825 should be fully credited towards the requirements of theoretical knowledge instruction and examination for an competency-based IR(A) according to Annex 6 Aa.

010 00 00 00	**AIR LAW**
010 04 00 00	PERSONNEL LICENSING
010 05 00 00	RULES OF THE AIR

010 06 00 00	PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS OPS)
010 07 00 00	AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT
010 08 00 00	AERONAUTICAL INFORMATION SERVICE
010 09 00 00	AERODROMES (ICAO Annex 14, Volume I, Aerodrome Design and Operations)
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**
022 02 00 00	MEASUREMENT OF AIR DATA PARAMETERS
022 04 00 00	GYROSCOPIC INSTRUMENTS
022 13 00 00	INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS
033 00 00 00	**FLIGHT PLANNING AND MONITORING**
033 02 00 00	FLIGHT PLANNING FOR IFR FLIGHTS
033 03 00 00	FUEL PLANNING
033 04 00 00	PRE-FLIGHT PREPARATION
033 05 00 00	ICAO FLIGHT PLAN (ATS FLIGHT PLAN)
040 00 00 00	**HUMAN PERFORMANCE**
040 01 00 00	HUMAN FACTORS: BASIC CONCEPTS
040 02 00 00	BASIC AVIATION PHYSIOLOGY AND HEALTH MAINTENANCE
040 03 00 00	BASIC AVIATION PSYCHOLOGY
050 00 00 00	**METEOROLOGY**
050 01 00 00	THE ATMOSPHERE
050 02 00 00	WIND
050 03 00 00	THERMODYNAMICS
050 04 00 00	CLOUDS AND FOG
050 05 00 00	PRECIPITATION
050 06 00 00	AIR MASSES AND FRONTS
050 07 00 00	PRESSURE SYSTEMS
050 08 00 00	CLIMATOLOGY
050 09 00 00	FLIGHT HAZARDS
050 10 00 00	METEOROLOGICAL INFORMATION
062 00 00 00	**RADIO NAVIGATION**
062 02 00 00	RADIO AIDS
062 03 00 00	RADAR
062 05 00 00	AREA NAVIGATION SYSTEMS, RNAV/FMS
092 00 00 00	**IFR COMMUNICATIONS**
092 01 00 00	DEFINITIONS
092 02 00 00	GENERAL OPERATING PROCEDURES
092 03 00 00	ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE
092 04 00 00	DISTRESS AND URGENCY PROCEDURES
092 05 00 00	RELEVANT WEATHER INFORMATION TERM
092 06 00 00	GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES
092 07 00 00	MORSE CODE

AMC2 FCL.615(b) IR - Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Air Law (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR(A) and EIR
010 00 00 00	**AIR LAW**	
010 04 00 00	**PERSONNEL LICENSING**	
010 04 02 00	**Regulation on Air Crew — Part-FCL**	
010 04 02 01	Definitions	
LO	Define the following: Category of aircraft, cross country flight, dual instruction time, flight time, flight time as SPIC, instrument time, instrument flight time, instrument ground time, MCC, multi-pilot aeroplanes, night, PPL, CPL, proficiency check, rating, renewal, revalidation, skill test, solo flight time, type of aircraft	x
010 04 02 02	Part-FCL	
LO	Name the content of PART-FCL	x
010 04 02 05	Ratings	
LO	Explain the requirements for plus validity and privileges of Instrument Ratings	x
010 05 00 00	**RULES OF THE AIR**	
010 05 02 00	**Applicability of the Rules of the Air**	
LO	Explain the duties of the PIC concerning pre-flight actions in case of an IFR flight	x
010 05 03 00	**General Rules**	
LO	Describe the requirements when carrying out simulated instrument flights	x
LO	Explain why a time check has to be obtained before flight	x
LO	Describe the required actions to be carried out, if the continuation of a controlled VFR flight in VMC is not practicable anymore	x
LO	Describe the provisions for transmitting a position report to the appropriate ATS Unit including time of transmission and normal content of the message	x
LO	Describe the necessary action when an aircraft is experiencing a COM failure	x
010 05 05 00	**Instrument Flight Rules (IFR)**	
LO	Describe the Instrument Flight Rules as contained in Chapter 5 of ICAO Annex 2	x

010 06 00 00	**PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS OPS)**	
010 06 03 00	**Departure procedures**	
010 06 03 01	General criteria (assuming all engines operating)	
LO	Name the factors dictating the design of instrument departure procedures	x
LO	Explain in which situations the criteria for omni-directional departures are applied	x
010 06 03 02	Standard Instrument Departures (SIDs)	
LO	Define the terms 'straight departure' and 'turning departure'	x
LO	State the responsibility of the operator when unable to utilize the published departure procedures	x
010 06 03 03	Omni-directional departures	
LO	Explain when the 'omni-directional method' is used for departure	x
LO	Describe the solutions when an omni-directional procedures is not possible	x
010 06 03 04	Published information	
LO	State the conditions for the publication of a SID and/or RNAV route	x
LO	Describe how omni-directional departures are expressed in the appropriate publication	x
010 06 03 05	Area Navigation (RNAV) Departure Procedures and RNP-based Departures	
LO	Explain the relationship between RNAV/RNP-based departure procedures and those for approaches	x
010 06 04 00	**Approach procedures**	
010 06 04 01	General criteria	
LO	Name the five possible segments of an instrument approach procedure	x
LO	Give reasons for establishing aircraft categories for the approach	x
LO	State the maximum angle between the final approach track and the extended RWY centre-line to still consider a non-precision-approach as being a 'Straight-In Approach'	x
LO	State the minimum obstacle clearance provided by the minimum sector altitudes (MSA) established for an aerodrome	x
LO	Describe the point of origin, shape, size and sub-divisions of the area used for MSAs	x

LO	State that a pilot shall apply wind corrections when carrying out an instrument approach procedures	x
LO	Name the most significant performance factor influencing the conduct of Instrument Approach Procedures	x
LO	Explain why a Pilot should not descend below OCA/Hs which are established for -precision approach procedures -a non-precision approach procedures — visual (circling) procedures	x
LO	Describe in general terms, the relevant factors for the calculation of operational minima	x
LO	Translate the following abbreviations into plain language: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H	x
LO	Explain the relationship between the terms: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H	x
010 06 04 02	Approach Procedure Design	x
LO	Describe how the vertical cross-section for each of the five approach segments is broken down into the various areas	x
LO	State within which area of the cross-section the Minimum Obstacle Clearance (MOC) is provided for the whole width of the area	x
LO	Define the terms IAF, IF, FAF, MAPt and TP	x
LO	State the accuracy of facilities providing track (VOR, ILS, NDB)	
LO	Describe the basic information relating to approach area splays	x
LO	State the optimum descent gradient (preferred for a precision approach) in degrees and per cent	x
010 06 04 03	Arrival and approach segments	
LO	Name the five standard segments of an instrument APP procedure and state the beginning and end for each of them	x
LO	Describe where an ARR route normally ends	x
LO	State whether or not omni-directional or sector arrivals can be provided	x
LO	Explain the main task for the initial APP segment	x
LO	Describe the maximum angle of interception between the initial APP segment and the intermediate APP segment (provided at the intermediate fix) for a precision APP and a non-precision APP	x
LO	Describe the main task of the intermediate APP segment	x
LO	State the main task of the final APP segment	x
LO	Name the two possible aims of a final APP	x

LO	Explain the term 'final approach point' in case of an ILS approach	x
LO	State what happens if an ILS GP becomes inoperative during the APP	x
010 06 04 04	Missed Approach	
LO	Name the three phases of a missed approach procedure and describe their geometric limits	x
LO	Describe the main task of a missed approach procedure	x
LO	State at which height/altitude the missed approach is assured to be initiated	x
LO	Define the term 'missed approach point (MAPt)'	x
LO	Describe how an MAPt may be established in an approach procedure	x
LO	State the pilot's reaction if, upon reaching the MAPt, the required visual reference is not established	x
LO	Describe what a pilot is expected to do in the event a missed approach is initiated prior to arriving at the MAPt	x
LO	State whether the pilot is obliged to cross the MAPt at the height/altitude required by the procedure or whether he is allowed to cross the MAPt at an altitude/height greater than that required by the procedure	x
010 06 04 05	Visual manoeuvring (circling) in the vicinity of the aerodrome:	
LO	Describe what is meant by 'visual manoeuvring (circling)'	x
LO	Describe how a prominent obstacle in the visual manoeuvring (circling) area outside the final approach and missed approach area has to be considered for the visual circling	x
LO	State for which category of aircraft the obstacle clearance altitude/height within an established visual manoeuvring (circling) area is determined	x
LO	Describe how an MDA/H is specified for visual manoeuvring (circling) if the OCA /H is known	x
LO	State the conditions to be fulfilled before descending below MDA/H in a visual manoeuvring (circling) approach	x
LO	Describe why there can be no single procedure designed that will cater for conducting a circling approach in every situation	x
LO	State how the pilot is expected to behave after initial visual contact during a visual manoeuvring (circling)	x
LO	Describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach	x
010 06 04 06	Area navigation (RNAV) approach procedures based on VOR/DME	

LO	Describe the provisions that must be fulfilled before carrying out VOR/DME RNAV approaches	x
LO	Explain the disadvantages of the VOR/DME RNAV system	x
LO	List the factors on which the navigational accuracy of the VOR/DME RNAV system depends	x
LO	State whether the VOR/DME/RNAV approach is a precision or a non-precision procedure	x
010 06 05 00	**Holding procedures**	
010 06 05 01	Entry and Holding	
LO	Explain why deviations from the in-flight procedures of a holding established in accordance with ICAO Doc 8168 are dangerous	x
LO	State that if for any reasons a pilot is unable to conform to the procedures for normal conditions laid down for any particular holding pattern, he/she should advise ATC as early as possible.	x
LO	Describe how the right turns holdings can be transferred to left turn holding patterns	x
LO	Describe the shape and terminology associated with the holding pattern	x
LO	State the bank angle and rate of turn to be used whilst flying in a holding pattern	x
LO	Explain why pilots in a holding pattern should attempt to maintain tracks and how this can be achieved	x
LO	Describe where outbound timing begins in a holding pattern	x
LO	State where the outbound leg in a holding terminates if the outbound leg is based on DME	x
LO	Describe the three heading entry sectors for entries into a holding pattern	x
LO	Define the terms ‘parallel entry’, ‘offset entry’ and ‘direct entry’	x
LO	Determine the correct entry procedure for a given holding pattern	x
LO	State the still air time for flying the outbound entry heading with or without DME	x
LO	Describe what the pilot is expected to do when clearance is received specifying the time of departure from the holding point	x
010 06 05 02	Obstacle clearance (except table)	
LO	Describe the layout of the basic holding area, entry area and buffer area of a holding pattern	x

LO	State which obstacle clearance is provided by a minimum permissible holding level referring to the holding area, the buffer area (general only) and over high terrain or in mountainous areas	x
010 06 06 00	**Altimeter setting procedures**	
010 06 06 01	Basic requirements and procedures	
LO	Describe the two main objectives for altimeter settings	x
LO	Define the terms 'QNH' and 'QFE'	x
LO	Describe the different terms of altitude or flight levels respectively which are the references during climb or descent to change the altimeter setting from QNH to 1013.2 hPa and vice versa	x
LO	Define the term 'Flight Level' (FL)	x
LO	State where flight level zero shall be located	x
LO	State the interval by which consecutive flight levels shall be separated	x
LO	Describe how flight levels are numbered	x
LO	Define the term 'Transition Altitude'	x
LO	State how Transition Altitudes shall normally be specified	x
LO	Explain how the height of the Transition Altitude is calculated and expressed in practice	x
LO	State where Transition Altitudes shall be published	x
LO	Define the term 'Transition Level'	x
LO	State when the Transition Level is normally passed to aircraft	x
LO	State how the vertical position of aircraft shall be expressed at or below the Transition Altitude and Transition Level	x
LO	Define the term 'Transition Layer'	x
LO	Describe when the vertical position of an aircraft passing through the transition layer shall be expressed in terms of flight levels and when in terms of altitude	x
LO	State when the QNH altimeter setting shall be made available to departing aircraft	x
LO	Explain when the vertical separation of aircraft during en-route flight shall be assessed in terms of altitude and when in terms of flight levels	x
LO	Explain when, in air-ground communications during an en-route flight, the vertical position of an aircraft shall be expressed in terms of altitude and when in terms of flight levels	x

LO	Describe why QNH altimeter setting reports should be provided from sufficient locations	x
LO	State how a QNH altimeter setting shall be made available to aircraft approaching a controlled aerodrome for landing	x
LO	State under which circumstances the vertical position of an aircraft above the transition level may be referenced to altitudes	x
010 06 06 02	Procedures for Operators and Pilots	
LO	State the three requirements that altitudes or flight levels selected should have	x
LO	Describe a pre-flight operational test in case of QNH setting and in case of QFE setting including indication (error) tolerances referred to the different test ranges	x
LO	State on which setting at least one altimeter shall be set prior to take off	x
LO	State where during the climb the altimeter setting shall be changed from QNH to 1013.2 hPa	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the transition level	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the actual QNH altimeter setting	x
LO	State where the altimeter settings shall be changed from 1013.2 hPa to QNH during descent for landing	x
010 06 07 00	**Simultaneous Operation on parallel or near-parallel instrument Runways**	
LO	Describe the difference between independent and dependent parallel approaches	x
LO	Describe the following different operations: — Simultaneous instrument departures — Segregated parallel approaches/departures — Semi-mixed and mixed operations	x
010 06 08 00	**Secondary surveillance radar (transponder) operating procedures**	
010 06 08 01	Operation of transponders	
LO	State when and where the pilot shall operate the transponder	x
LO	State the modes and codes that the pilot shall operate in the absence of any ATC directions or regional air navigation agreements	x
LO	Indicate when the pilot shall operate Mode S	x
LO	State when the pilot shall ‘SQUAWK IDENT’	x

LO	State the transponder mode and code to indicate: -a state of emergency -a Communication failure - unlawful interference	x
LO	Describe the consequences of a transponder failure in flight	x
LO	State the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at this aerodrome is possible	x
010 06 08 02	Operation of ACAS equipment	
LO	Describe the main reason for using ACAS	x
010 07 00 00	**AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT**	
010 07 01 00	**ICAO Annex 11 — Air Traffic Services**	
010 07 01 03	Airspace	
LO	Understand the various rules and services that apply in the various classes of airspace	x
010 07 01 04	Air Traffic Control Services	
LO	Name the ATS units providing ATC service (area control service, approach control service, aerodrome control service)	x
LO	Describe which unit(s) may be assigned with the task to provide specified services on the apron	x
LO	Name the purpose of clearances issued by an ATC unit	x
LO	Describe the aim of clearances issued by ATC with regard to IFR, VFR or special VFR flights and refer to the different airspaces	x
LO	List the various (five possible) parts of an ATC clearance	x
LO	State how ATC shall react when it becomes apparent that traffic, additional to that one already accepted, cannot be accommodated within a given period of time at a particular location or in a particular area, or can only be accommodated at a given rate	x
010 07 02 00	**ICAO Document 4444 — Air Traffic Management**	
010 07 02 01	Foreword (Scope and purpose)	
LO	State whether or not a clearance issued by ATC units does include prevention of collision with terrain and if there is an exception to this, name the exception	x
010 07 02 03	ATS System Capacity and Air Traffic Flow Management	
LO	Explain when and where an air traffic flow management (ATFM) service shall be implemented	x
010 07 02 05	ATC Clearances	

LO	Explain 'the sole scope and purpose' of an ATC clearance	x
LO	State on which information the issue of an ATC clearance is based	x
LO	Describe what a PIC should do if an ATC clearance is not suitable	x
LO	Indicate who bears the responsibility for maintaining applicable rules and regulations whilst flying under the control of an ATC unit	x
LO	Explain what is meant by the expression 'clearance limit'	x
LO	Explain the meaning of the phrases 'cleared via flight planned route', 'cleared via (designation) departure' and 'cleared via (designation) arrival' in an ATC clearance.	x
LO	List which items of an ATC clearance shall always be read back by the flight crew	x
010 07 02 06	Horizontal Speed Control Instructions	
LO	Explain the reason for speed control by ATC	x
LO	Define the maximum speed changes that ATC may impose	x
LO	State within which distance from the threshold the PIC must not expect any kind of speed control	x
010 07 02 07	Change from IFR to VFR flight	
LO	Explain how the change from IFR to VFR can be initiated by the PIC	x
LO	Indicate the expected reaction of the appropriate ATC unit upon a request to change from IFR to VFR	x
010 07 02 09	Altimeter Setting Procedures	
LO	Define the following terms: — transition level — transition layer — and transition altitude	x
LO	Indicate how the vertical position of an aircraft in the vicinity of an aerodrome shall be expressed at or below the transition altitude, at or above the transition level and while climbing or descending through the transition layer	x
LO	Describe when the height of an aircraft using QFE during an NDB approach is referred to the landing threshold instead of the aerodrome elevation	x
LO	Indicate how far altimeter settings provided to aircraft shall be rounded up or down	x
LO	Define the expression 'lowest usable flight level'	x
LO	Determine how the vertical position of an aircraft on a flight en-route is expressed at or above the lowest usable flight level and below the lowest usable flight level	x

LO	State who establishes the transition level to be used in the vicinity of an aerodrome	x
LO	Decide how and when a flight crew shall be informed about the transition level	x
LO	State whether or not the pilot can request the transition level to be included in the approach clearance	x
LO	State in what kind of clearance the QNH altimeter setting shall be included	x
010 07 02 10	Position Reporting	
LO	Describe when position reports shall be made by an aircraft flying on routes defined by designated significant points	x
LO	List the six items that are normally included in a voice position report	x
LO	Name the requirements for using a simplified position report with Flight level, next position (and time over) and ensuing significant points omitted	x
LO	Name the item of a position report which must be forwarded to ATC with the initial call after changing to a new frequency	x
LO	Indicate the item of a position report which may be omitted if SSR Mode C is used	x
010 07 02 12	Separation methods and minima	
LO	Explain the general provisions for the separation of controlled traffic	x
LO	Name the different kind of separation used in aviation	x
LO	Understand the difference between the type of separation provided within the various classes of airspace and between the various types of flight	x
LO	State who is responsible for the avoidance of collision with other aircraft when operating in VMC	x
LO	State the ICAO documents in which details of current separation minima are prescribed	x
LO	Describe how vertical separation is obtained	x
LO	State the required vertical separation minimum	x
LO	Describe how the cruising levels of aircraft flying to the same destination and the expected approach sequence are correlated with each other	x
LO	Name the conditions that must be adhered to, when two aircraft are cleared to maintain a specified vertical separation between them during climb or descent	x
LO	List the two main methods for horizontal separation	x

LO	Describe how lateral separation of aircraft at the same level may be obtained	x
LO	Explain the term ‘Geographical Separation’	x
LO	Describe track separation between aircraft using the same navigation aid or method	x
LO	Describe the three basic means for the establishment of longitudinal separation	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed	x
LO	Indicate the standard horizontal radar separation in NM	x
LO	State the wake turbulence radar separation for aircraft in the APP and DEP phases of a flight when an aircraft is operating directly behind another aircraft at the same ALT or less than 300 m (1 000 ft) below	x
010 07 02 13	Separation in the vicinity of aerodromes	
LO	State the condition to enable ATC to initiate a visual approach for an IFR flight	x
LO	Indicate whether or not separation will be provided by ATC between an aircraft executing a visual approach and other arriving or departing aircraft	x
LO	State in which case when the flight crew are not familiar with the instrument approach procedure being carried out, that only the final approach track has to be forwarded to them by ATC	x
LO	Describe which flight level should be assigned to an aircraft first arriving over a holding fix for landing	x
LO	Talk about the priority that will be given to aircraft for a landing	x
LO	Understand the situation when a pilot of an aircraft in an approach sequence indicates his intention to hold for weather improvements	x
LO	Explain the term ‘Expected Approach Time’ and the procedures for its use	x
LO	State the reasons which could probably lead to the decision to use another take-off or landing direction than the one into the wind	x
LO	Name the possible consequences for a PIC if the ‘RWY-in-use’ is not considered suitable for the operation involved	x
010 07 02 14	Miscellaneous separation procedures	
LO	Be familiar with the separation of aircraft holding in flight	x
LO	Be familiar with the minimum separation between departing aircraft	x

LO	Be familiar with the minimum separation between departing and arriving aircraft	x
LO	Be familiar with the non-radar wake turbulence longitudinal separation minima	x
LO	Know about a clearance to ‘maintain own separation’ while in VMC	x
LO	Give a brief description of ‘Essential Traffic’ and ‘Essential Traffic Information’	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed	x
010 07 02 15	Arriving and Departing aircraft	
LO	List the elements of information which shall be transmitted to an aircraft as early as practicable if an approach for landing is intended	x
LO	List the information to be transmitted to an aircraft at the commencement of final approach	x
LO	List the information to be transmitted to an aircraft during final approach	x
LO	State the sequence of priority between aircraft landing (or in the final stage of an approach to land) and aircraft intending to depart	x
LO	Explain the factors that influence the approach sequence	x
LO	State the significant changes in the meteorological conditions in the take-off or climb-out area that shall be transmitted without delay to a departing aircraft.	x
LO	Describe what information shall be forwarded to a departing aircraft as far as visual or non-visual aids are concerned	x
LO	State the significant changes that shall be transmitted as early as practicable to an arriving aircraft, particularly changes in the meteorological conditions.	x
010 07 02 16	Procedures for Aerodrome Control Service	
LO	Describe the general tasks of the Aerodrome Control Tower (TWR) when issuing information and clearances to aircraft under its control	x
LO	List for which aircraft and their given positions or flight situations the TWR shall prevent collisions	x
LO	Name the operational failure or irregularity of AD equipment which shall be reported to the TWR immediately	x
LO	State that, after a given period of time, the TWR shall report to the ACC or FIC if an aircraft does not land as expected	x
LO	Describe the procedures to be observed by the TWR whenever VFR operations are suspended	x

010 07 02 17	Radar services	
LO	State to what extent the use of radar in air traffic services may be limited	x
LO	State what radar derived information shall be available for display to the controller as a minimum	x
LO	Name the two basic identification procedures used with radar	x
LO	Define the term 'PSR'	x
LO	Describe the circumstances under which an aircraft provided with radar service should be informed of its position	x
LO	List the possible forms of position information passed to the aircraft by radar services	x
LO	Define the term 'radar vectoring'	x
LO	State the aims of radar vectoring as shown in ICAO Doc 4444	x
LO	State how radar vectoring shall be achieved	x
LO	Describe the information which shall be given to an aircraft when radar vectoring is terminated and the pilot is instructed to resume own navigation	x
LO	Explain the procedures for the conduct of Surveillance Radar Approaches (SRA)	x
LO	Describe what kind of action (concerning the transponder) the pilot is expected to perform in case of emergency if he has previously been directed by ATC to operate the transponder on a specific code	x
010 07 02 19	Procedures related to emergencies, communication failure and contingencies	
LO	State the Mode and Code of SSR equipment a pilot might operate in a (general) state of emergency or (specifically) in case the aircraft is subject to unlawful interference	x
LO	State the special rights an aircraft in a state of emergency can expect from ATC	x
LO	Describe the expected action of aircraft after receiving a broadcast from ATS concerning the emergency descent of an aircraft	x
LO	State how it can be ascertained, in case of a failure of two-way communication, whether the aircraft is able to receive transmissions from the ATS unit	x
LO	Explain the assumption based on which separation shall be maintained if an aircraft is known to experience a COM failure in VMC or in IMC	x
LO	State on which frequencies appropriate information, for an aircraft encountering two way COM failure, will be sent by ATS	x

LO	Describe the expected activities of an ATS-unit after having learned that an aircraft is being intercepted in or outside its area of responsibility	x
LO	State what is meant by the expression 'Strayed aircraft' and 'Unidentified aircraft'	x
010 08 00 00	**AERONAUTICAL INFORMATION SERVICE**	
010 08 02 00	**Definitions in ICAO Annex 15**	
LO	Recall the following definitions: Aeronautical Information Circular (AIC), Aeronautical Information Publication (AIP), AIP amendment, AIP supplement, AIRAC, danger area, Integrated Aeronautical Information Package, international airport, international NOTAM office (NOF), manoeuvring area, movement area, NOTAM, pre-flight information bulletin (PIB), prohibited area, restricted area, SNOWTAM, ASHTAM	x
010 08 04 00	**Integrated Aeronautical Information Package**	
010 08 04 01	Aeronautical Information Publications (AIP)	
LO	State in which main part of the AIP the following information can be found: — Differences from ICAO Standards, Recommended Practices and Procedures — Location indicators, aeronautical information services, minimum flight altitude, VOLMET service, SIGMET service — General rules and procedures (especially general rules, VFR, IFR, ALT setting procedure, interception of civil aircraft, unlawful interference, air traffic incidents), — ATS airspace (especially FIR, UIR, TMA), — ATS routes (especially lower ATS routes, upper ATS routes, area navigation routes) — Aerodrome data including Aprons, TWYs and check locations/positions data — Navigation warnings (especially prohibited, restricted and danger areas) — aircraft instruments, equipment and flight documents — AD surface movement guidance and control system and markings, — RWY physical characteristics, declared distances, APP and RWY lighting, — AD radio navigation and landing aids, — charts related to an AD — entry, transit and departure of aircraft, passengers, crew and cargo	x
010 08 04 02	NOTAMs	
LO	Describe how information shall be published which in principal would belong to NOTAMs but includes extensive text and/or graphics	x
LO	Summarise essential information which lead to the issuance of a NOTAM	x
LO	Explain how information regarding snow, ice and standing water on AD pavements shall be reported	x
010 08 04 03	Aeronautical Information Regulation and Control (AIRAC)	
LO	List the circumstances of which the information concerned shall or should be distributed as AIRAC	x

LO	State the sequence in which AIRACs shall be issued and state how many days in advance of the effective date the information shall be distributed by AIS	x
010 08 04 05	Pre-flight and Post-flight Information/Data	
LO	Describe how a recapitulation of current NOTAM and other information of urgent character shall be made available to flight crews	x
010 09 00 00	**AERODROMES (ICAO Annex 14, Volume I, Aerodrome Design and Operations)**	
010 09 02 00	**Aerodrome data**	
010 09 02 01	Aerodrome Reference Point	
LO	Describe where the aerodrome reference point shall be located and where it shall normally remain	x
010 09 03 00	**Physical Characteristics**	
010 09 03 01	Runways	
LO	Acquaint yourself with the general considerations concerning runways associated with a Stopway or Clearway	x
010 09 03 02	Runway Strips	
LO	Explain the term ‘Runway strip’	x
010 09 03 03	Runway end safety area	
LO	Explain the term ‘RWY end safety area’	x
010 09 03 04	Clearway	
LO	Explain the term ‘Clearway’	x
010 09 03 05	Stopway	
LO	Explain the term ‘Stopway’	x
010 09 03 07	Taxiways	
LO	Describe where runway-holding positions shall be established	x
010 09 04 00	**Visual aids for navigation**	
010 09 04 02	Markings	
LO	Name the colours used for the various markings (RWY, TWY, aircraft stands, apron safety lines)	x
LO	Describe the application and characteristics of: — RWY centre line markings — THR marking	x
010 09 04 03	Lights	

LO	Describe mechanical safety considerations regarding elevated approach lights and elevated RWY, stopway and taxiway-lights	x
LO	Discuss the relationship of the intensity of RWY lighting, the approach lighting system and the use of a separate intensity control for different lighting systems	x
LO	List the conditions for the installation of an AD beacon and describe its general characteristics	x
LO	Name the different kinds of operations for which a simple APP lighting system shall be used	x
LO	Describe the basic installations of a simple APP lighting system including the dimensions and distances normally used	x
LO	Describe the principle of a precision APP category I lighting system including such information as location and characteristics Remark — This includes the 'Calvert' system with additional crossbars	x
LO	Describe the wing bars of PAPI and APAPI	x
LO	Interpret what the pilot will see during approach, using PAPI, APAPI, T-VASIS and ATVASIS	x
LO	Explain the application and characteristics of: — RWY edge lights — RWY threshold and wing bar lights — RWY end lights — RWY centre line lights — RWY lead in lights — RWY touchdown zone lights — Stopway lights — Taxiway centre line lights — Taxiway edge lights — Stop bars — Intermediate holding position lights — RWY guard lights — Road holding position lights	x
010 09 04 04	Signs	
LO	State the general purpose for installing signs	x
LO	Explain what signs are the only ones on the movement area utilising red	x
LO	List the provisions for illuminating signs	x
LO	State the purpose for installing mandatory instruction signs	x
LO	Name the kind of signs which mandatory instruction signs shall include	x
LO	Name the colours used with mandatory instruction signs	x
LO	Describe the location of: — a RWY designation sign at a taxiway/RWY intersection — a NO ENTRY sign — a RWY holding position sign	x
LO	Name the sign with which it shall be indicated that a taxiing aircraft is about to infringe an obstacle limitation surface or to interfere with the operation of radio navigation aids (e.g. ILS/MLS critical/sensitive area)	x

LO	Describe the various possible inscriptions on RWY designation signs and on holding position signs	x
LO	Describe the inscription on an Intermediate-holding position sign on a taxiway	x
010 09 08 00	**Attachment A to ICAO Annex 14, Volume 1 — Supplementary Guidance Material**	
010 09 08 03	Approach lighting systems	
LO	Name the two main groups of approach lighting systems	x
LO	Describe the two different versions of a simple approach lighting system	x
LO	Describe the two different basic versions of precision approach lighting systems for CAT I	x
LO	Describe how the arrangement of an approach lighting system and the location of the appropriate threshold are interrelated with each other	x

AMC3 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Aircraft General Knowledge — Instrumentation (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	**Syllabus details and associated Learning Objectives**	**CB-IR(A) and EIR**
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**	
022 02 00 00	**MEASUREMENT OF AIR DATA PARAMETERS**	
022 02 01 00	**Pressure measurement**	
022 02 01 02	Pitot/static system: design and errors	
LO	Describe the design and the operating principle of a: — static source — Pitot tube — combined Pitot/static probe	x
LO	For each of these indicate the various locations, describe the following associated errors: — position errors — instrument errors -errors due to a non-longitudinal axial flow (including manoeuvre-induced errors), and the means of correction and/or compensation	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed pressure	x
LO	List the affected instruments and explain the consequences for the pilot in case of a malfunction including blockage and leakage	x
LO	Describe alternate static sources and their effects when used	x
022 02 04 00	**Altimeter**	
LO	Define the following terms: -height, altitude, -indicated altitude, true altitude, -pressure altitude, density altitude	x
LO	Define the following barometric references: QNH, QFE, 1013,25 hPa	x
LO	Explain the operating principles of an altimeter	x

LO	Describe and compare the following three types of altimeters: — simple altimeter (single capsule) — sensitive altimeter (multi capsule) — servo-assisted altimeter	x
LO	Give examples of associated displays: pointer, multi pointer, drum, vertical straight scale	x
LO	Describe the following errors: — Pitot/static system errors — temperature error (air column not at ISA conditions) — time lag (altimeter response to change of height) and the means of correction	x
LO	Give examples of altimeter corrections table from an Aircraft Operations Manual (AOM)	x
LO	Describe the effects of a blockage or a leakage on the static pressure line	x
022 02 05 00	**Vertical Speed Indicator (VSI)**	
LO	Explain the operating principles of a VSI	x
LO	Describe and compare the following two types of vertical speed indicators: — barometric type — inertial type (inertial information provided by an Inertial Reference Unit)	x
LO	Describe the following VSI errors: — Pitot/static system errors — time lag and the means of correction	x
LO	Describe the effects on a VSI of a blockage or a leakage on the static pressure line	x
022 02 06 00	**Airspeed Indicator (ASI)**	
LO	Define IAS, CAS, EAS, TAS and state and explain the relationship between these speeds	x
LO	Describe the following ASI errors and state when they must be considered: — Pitot/static system errors — compressibility error — density error	x
LO	Explain the operating principles of an ASI (as appropriate to aeroplanes or helicopters)	x
LO	Describe the effects on an ASI of a blockage or a leak in the static and/or total pressure line(s)	x
022 03 00 00	**MAGNETISM — DIRECT READING COMPASS AND FLUX VALVE**	
022 04 00 00	**GYROSCOPIC INSTRUMENTS**	
022 04 01 00	**Gyroscope: basic principles**	
LO	Define a gyro	x
LO	Explain the fundamentals of the theory of gyroscopic forces	x
LO	Define the degrees of freedom of a gyro *Remark: As a convention, the degrees of freedom of a gyroscope do not include its own axis of rotation (the spin axis)*	x
022 04 02 00	**Rate of turn indicator /-Turn Co-ordinator — Balance (Slip) Indicator**	
LO	Explain the purpose of a rate of turn and balance (slip) indicator	x
LO	Define a rate-one turn	x
LO	Explain the relation between bank angle, rate of turn and TAS	x
LO	Explain why the indication of a rate of turn indicator is only correct for one TAS and when turn is co-ordinated	x
LO	Explain the purpose of a balance (slip) indicator	x
LO	Describe the indications of a rate of turn and balance (slip) indicator during a balanced, slip or skid turn	x
LO	Describe the construction and principles of operation of a Turn Co-ordinator (or Turn and Bank Indicator)	x
LO	Compare the rate of turn indicator and the turn co-ordinator	x
022 04 03 00	**Attitude Indicator (Artificial Horizon)**	

LO	Explain the purpose of the attitude indicator	x
LO	Describe the different designs and principles of operation of attitude indicators (air driven, electric)	x
LO	Describe the attitude display and instrument markings	x
022 04 04 00	**Directional gyroscope**	
LO	Explain the purpose of the directional gyroscope	x
LO	Describe the following two types of directional gyroscopes: — Air driven directional gyro — Electric directional gyro	x
022 04 06 00	**Solid-State Systems — AHRS**	
LO	Describe the basic principle of a solid-state Attitude and Heading Reference System (AHRS) using a solid state 3-axis rate sensor, 3-axis accelerometer and a 3-axis magnetometer	x
022 12 00 00	**ALERTING SYSTEMS, PROXIMITY SYSTEMS**	
022 13 00 00	**INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS**	
022 13 01 00	**Electronic display units**	
022 13 01 01	Design, limitations	
LO	List the different technologies used e.g. CRT and LCD and the associated limitations: — cockpit temperature — glare	x
022 13 02 00	**Mechanical Integrated instruments: ADI/HSI**	
LO	Describe an Attitude and Director Indicator (ADI) and a Horizontal Situation Indicator (HSI)	x
LO	List all the information that can be displayed for either instruments	x
022 13 03 00	**Electronic Flight Instrument Systems (EFIS)**	
022 13 03 01	Design, operation	
LO	List and describe the different components of an EFIS	x
022 13 03 02	Primary Flight Display (PFD), Electronic Attitude Director Indicator (EADI)	
LO	State that a PFD (or an EADI) presents a dynamic colour display of all the parameters necessary to control the aircraft	x
LO	List and describe the following information that can be displayed on the Primary Flight Display (PFD) unit of an aircraft: — Flight Mode Annunciation — basic T: — attitude — IAS — altitude — heading/track indications — vertical speed — maximum airspeed warning — selected airspeed —speed trend vector — selected altitude — current barometric reference — steering indications (FD command bars) — selected heading — Flight Path Vector (FPV) — Radio altitude — Decision height — ILS indications — ACAS (TCAS) indications	x

	— failure flags and messages	
022 13 03 03	Navigation Display (ND), Electronic Horizontal Situation Indicator (EHSI)	
LO	State that a ND (or an EHSI) provides a mode-selectable colour flight navigation display	x

AMC4 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Flight Planning and Flight Monitoring (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument (EIR) rating course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR(A) and EIR
033 00 00 00	**FLIGHT PLANNING AND FLIGHT MONITORING**	
033 02 00 00	**FLIGHT PLANNING FOR IFR FLIGHTS**	
033 02 01 00	**IFR Navigation plan**	
033 02 01 01	Airways and routes	
LO	Select the preferred airway(s) or route(s) considering: — Altitudes and Flight levels — Standard routes — ATC restrictions — Shortest distance — Obstacles — Any other relevant data	x
033 02 01 02	Courses and distances from en-route charts	
LO	Determine courses and distances	x
LO	Determine bearings and distances of waypoints from radio navigation aids	x
033 02 01 03	Altitudes	
LO	Define the following altitudes: — Minimum En-route Altitude (MEA) — Minimum Obstacle Clearance Altitude (MOCA) — Minimum Off Route Altitude (MORA) — Grid Minimum Off-Route Altitude (Grid MORA) — Maximum Authorised Altitude (MAA) — Minimum Crossing Altitude (MCA) — Minimum Holding Altitude (MHA)	x
LO	Extract the following altitudes from the chart(s): — Minimum En-route Altitude (MEA) — Minimum Obstacle Clearance Altitude (MOCA) — Minimum Off Route Altitude (MORA) — Grid Minimum Off-Route Altitude (Grid MORA) — Maximum Authorised Altitude (MAA) — Minimum Crossing Altitude (MCA) — Minimum Holding Altitude (MHA)	x
033 02 01 04	Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs)	
LO	Explain the reasons for studying SID and STAR charts	x
LO	State the reasons why the SID and STAR charts show procedures only in a pictorial presentation style which is not to scale	x

LO	Interpret all data and information represented on SID and STAR charts, particularly: — Routings. — Distances — Courses — Radials — Altitudes/Levels — Frequencies — Restrictions	x
LO	Identify SIDs and STARs which might be relevant to a planned flight	x
033 02 01 05	Instrument Approach Charts	
LO	State the reasons for being familiar with instrument approach procedures and appropriate data for departure, destination and alternate airfields	x
LO	Select instrument approach procedures appropriate for departure, destination and alternate airfields	x
LO	Interpret all procedures, data and information represented on Instrument Approach Charts, particularly: — Courses and Radials — Distances — Altitudes/Levels/Heights — Restrictions — Obstructions — Frequencies — Speeds and times — Decision Altitudes/Heights (DA/H) and Minimum Descent Altitudes/Heights (MDA/H) — Visibility and Runway Visual Ranges (RVR) — Approach light systems	x
033 02 01 06	Communications and Radio Navigation planning data	
LO	Find communication frequencies and call signs for the following: — Control agencies and service facilities — Flight information services (FIS) — Weather information stations — Automatic Terminal Information Service (ATIS)	x
LO	Find the frequency and/or identifiers of radio navigation aids	x
033 02 01 07	Completion of navigation plan	
LO	Complete the navigation plan with the courses, distances and frequencies taken from charts	x
LO	Find Standard Instrument Departure and Arrival Routes to be flown and/or to be expected	x
LO	Determine the position of Top of Climb (TOC) and Top of Descent (TOD) given appropriate data	x
LO	Determine variation and calculate magnetic/true courses	x
LO	Calculate True Air Speed (TAS) given aircraft performance data, altitude and Outside Air Temperature (OAT)	x
LO	Calculate Wind Correction Angles (WCA)/Drift and Ground Speeds (GS)	x
LO	Determine all relevant Altitudes/Levels particularly MEA, MOCA, MORA , MAA, MCA, MRA and MSA	x
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields	x
033 03 00 00	**FUEL PLANNING**	
033 03 01 00	General	

LO	Convert between volume, mass and density given in different units which are commonly used in aviation	x
LO	Determine relevant data from flight manual, such as fuel capacity, fuel flow/consumption at different power/thrust settings, altitudes and atmospheric conditions	x
LO	Calculate attainable flight time/range given fuel flow/consumption and available amount of fuel	x
LO	Calculate the required fuel given fuel flow/consumption and required time/range to be flown	x
LO	Calculate the required fuel for an IFR flight given expected meteorological conditions and expected delays under defined conditions.	x
033 04 00 00	**PRE-FLIGHT PREPARATION**	
033 04 01 00	NOTAM briefing	
033 04 01 01	Ground facilities and services	
LO	Check that ground facilities and services required for the planned flight are available and adequate	x
033 04 01 02	Departure, destination and alternate aerodromes	
LO	Find and analyse the latest state at the departure, destination and alternate aerodromes, in particular for: — Opening hours — Work in Progress (WIP) — Special procedures due to Work in Progress (WIP) — Obstructions — Changes of frequencies for communications, navigation aids and facilities	x
033 04 01 03	Airway routings and airspace structure	
LO	Find and analyse the latest en-route state for: — Airway(s) or Route(s) — Restricted, Dangerous and Prohibited areas — Changes of frequencies for communications, navigation aids and facilities	x
033 04 02 00	Meteorological briefing	
033 04 02 02	Update of navigation plan using the latest meteorological information:	
LO	Confirm the optimum altitude/FL given wind, temperature and aircraft data	x
LO	Confirm magnetic headings and ground speeds	x
LO	Confirm the individual leg times and the total time en route	x
LO	Confirm the total time en route for the trip to the destination	x
LO	Confirm the total time from destination to the alternate airfield	x
033 04 02 05	Update of fuel log	
LO	Calculate revised fuel data in accordance with changed conditions	x
033 05 00 00	**ICAO FLIGHT PLAN (ATS Flight Plan)**	
033 05 01 00	Individual Flight Plan	
033 05 01 01	Format of Flight Plan	
LO	State the reasons for a fixed format of an ICAO ATS Flight Plan (FPL)	x
LO	Determine the correct entries to complete an FPL plus decode and interpret the entries in a completed FPL, particularly for the following: — Aircraft identification (Item 7) — Flight rules and type of flight (Item 8) — Number and type of aircraft and wake turbulence category (Item 9) — Equipment (Item 10) — Departure aerodrome and time (Item 13) — Route (Item 15)	x

	— Destination aerodrome, total estimated elapsed time and Alternate aerodrome (Item 16) — Other information (Item 18) — Supplementary Information (Item 19)	
033 05 01 02	Completion of an ATS Flight Plan (FPL)	
LO	Complete the Flight Plan using information from the following: — Navigation plan — Fuel plan — Operator's records for basic aircraft information	x
033 05 03 00	Submission of an ATS Flight Plan (FPL)	
LO	Explain the requirements for the submission of an ATS Flight Plan	x
LO	Explain the actions to be taken in case of Flight Plan changes	x
LO	State the actions to be taken in case of inadvertent changes to Track, TAS and time estimate affecting the current Flight Plan	x
LO	Explain the procedures for closing a Flight Plan	x

AMC5 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Human Performance (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus Reference	Syllabus and Learning Objectives	CB-IR (A) and EIR
040 00 00 00	**HUMAN PERFORMANCE**	
040 01 00 00	**HUMAN FACTORS: BASIC CONCEPTS**	
040 01 03 00	**Flight safety concepts**	
LO	Explain the three components of the Threat and Error Management Model (TEM).	x
LO	Explain and give examples of latent threats	x
LO	Explain and give examples of Environmental Threats	x
LO	Explain and give examples of Organizational Threats	x
LO	Explain and give a definition of Error according the TEM-model in ICAO Annex 1	x
LO	Give examples of different countermeasures which may be used in order to manage Threats, Errors and Undesired Aircraft States	x
LO	Explain and give examples of Procedural Error	x
040 01 04 00	**Safety culture**	
LO	Distinguish between 'open cultures' and 'closed cultures'	x
LO	Illustrate how Safety Culture is reflected by National Culture	x
LO	Explain James Reason's Swiss Cheese Model	x
LO	State important factors that promote a good Safety Culture	x
LO	Distinguish beteween 'Just Culture' and 'Non-punative Culture'	x
LO	Name five components which form Safety Culture (According to James Reason)	x
040 02 00 00	**BASIC AVIATION PHYSIOLOGY AND HEALTH MAINTENANCE**	
040 02 01 00	**Basics of flight physiology**	
040 02 01 02	Respiratory and circulatory systems	
LO	Define 'linear', 'angular' and 'radial acceleration'	x

LO	Describe the effects of acceleration on the circulation and blood volume distribution	x
LO	List the factors determining the effects of acceleration on the human body	x
LO	Describe measures which may be taken to increase tolerance to positive acceleration	x
LO	List the effects of positive acceleration with respect to type, sequence and the corresponding G-load	x
040 02 02 00	**Man and Environment: the sensory system**	
LO	List the different senses	x
LO	State the multi-sensory nature of human perception	x
040 02 02 04	Equilibrium	
Functional Anatomy		
LO	List the main elements of the vestibular apparatus	x
LO	State the functions of the vestibular apparatus on the ground and in flight	x
LO	Distinguish between the component parts of the vestibular apparatus in the detection of linear and angular acceleration as well as on gravity	x
LO	Explain how the semicircular canals are stimulated	x
Motion sickness		
LO	Describe air-sickness and its accompanying symptoms	x
LO	List the causes of motion sickness	x
LO	Describe the necessary actions to be taken to counteract the symptoms of motion sickness	x
040 02 02 05	Integration of sensory inputs	
LO	State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight	x
LO	Define the term 'illusion'	x
LO	Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons and surface planes	x
LO	Relate these illusions to problems that may be experienced in flight and identify the danger attached to them	x
LO	State the conditions which cause the 'black hole' effect and 'empty field myopia'	x
LO	Give examples of approach and landing illusions, state the danger involved and give recommendations to avoid or counteract these problems	x
LO	State the problems associated with flickering lights (strobe-lights, anti-collision lights, etc.)	x
LO	Give examples of vestibular illusions such as Somatogyral (the Leans), Coriolis, Somatogravic and g-effect illusions	x
LO	Relate the above mentioned vestibular illusions to problems encountered in flight and state the dangers involved	x
LO	List and describe the function of the proprioceptive senses ('Seat-of-the-Pants-Sense')	x
LO	Relate illusions of the proprioceptive senses to the problems encountered during flight	x
LO	State that the 'Seat-of-the-Pants-Sense' is completely unreliable when visual contact with the ground is lost or when flying in IMC or poor visual horizon	x
LO	Differentiate between Vertigo, Coriolis effect and spatial disorientation	x
LO	Explain The Flicker Effect (Stroboscopic Effect) and discuss counter measures	x

LO	Explain how spatial disorientation can result from a mismatch in sensory input and information processing	x
LO	List the measures to prevent and/or overcome spatial disorientation	x
040 03 00 00	**BASIC AVIATION PSYCHOLOGY**	
040 03 02 00	**Human error and reliability**	
040 03 02 02	Mental models and situation awareness	
LO	Define the term 'situation awareness'	x
LO	List cues which indicate the loss of situation awareness and name the steps to regain it	x
LO	List factors which influence one's Situation Awareness both positively and negatively and stress the importance of Situation Awareness in the context of flight safety	x
LO	Define the term 'mental model' in relation to a surrounding complex situation	x
LO	Describe the advantage/disadvantage of mental models	x
LO	Explain the relationship between personal 'mental models' and the creation of cognitive illusions	x
040 03 02 03	Theory and model of human error	
LO	Define the term 'error'	x
LO	Explain the concept of the 'error chain'	x
LO	Differentiate between an isolated error and an error chain	x
LO	Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations)	x
LO	Discuss the above errors and their relevance in-flight	x
LO	Distinguish between an active and a latent error and give examples	x
040 03 02 04	Error generation	
LO	Distinguish between internal and external factors in error generation	x
LO	Identify possible sources of internal error generation	x
LO	Define and discuss the two errors associated with motor programmes	x
LO	List the three main sources for external error generation in the cockpit	x
LO	Give examples to illustrate the following factors in external error generation in the cockpit: — Ergonomics — Economics — Social environment	x
LO	Name major goals in the design of human centred man-machine interfaces	x
LO	Define the term 'error tolerance'	x
LO	List (and describe) strategies which are used to reduce human error	x
040 03 03 00	**Decision making**	
040 03 03 01	Decision-making concepts	
LO	Define the term 'deciding' and 'decision-making'	x
LO	Describe the major factors on which a decision-making should be based during the course of a flight	x
LO	Describe the main human attributes with regard to decision making	x
LO	Discuss the nature of bias and its influence on the decision making process	x
LO	Describe the main error sources and limits in an individual's decision making mechanism	x
LO	State the factors upon which an individual's risk assessment is based	x
LO	Explain the relationship between risk assessment, commitment, and pressure of time on decision making strategies	x

LO	Describe the positive and negative influences exerted by other group members on an individual's decision making process	x
LO	Explain the general idea behind the creation of a model for decision making based upon: — definition of the aim — collection of information — risk assessment — development of options — evaluation of options — decision — implementation — consequences — review and feedback	x
040 03 04 00	**Avoiding and managing errors: cockpit management**	
040 03 04 01	Safety awareness	
LO	Justify the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks	x
LO	Stress the overall importance of constantly and positively striving to monitor for errors and thereby maintaining situation awareness	x
040 03 06 00	**Human overload and underload**	
040 03 06 02	Stress	
LO	Explain the biological reaction to stress by means of the general adaptation syndrome (GAS)	x
LO	Name the 3 phases of the GAS	x
LO	Name the symptoms of stress relating to the different phases of the GAS	x
LO	Explain how stress is cumulative and how stress from one situation can be transferred to a different situation	x
LO	Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future	x
LO	Describe the effect of human under/overload on effectiveness in the cockpit	x
LO	List sources and symptoms of human underload	x
040 03 07 00	**Advanced cockpit automation**	
040 03 07 01	Advantages and disadvantages	
LO	Define and explain the basic concept of automation	x
LO	List the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situation awareness and crew coordination	x
LO	State the advantages and disadvantages of the two components of the man-machine system with regard to information input and processing, decision making, and output activities	x
LO	Explain the 'ironies of automation'	x
LO	Give examples of methods to overcome the disadvantages of automation	x
040 03 07 02	Automation complacency	
LO	State the main weaknesses in the monitoring of automatic systems	x
LO	Explain the following terms in connection with automatic systems: — Passive monitoring — Blinkered concentration — Confusion — Mode awareness	x

LO	Give examples of actions which may be taken to counteract ineffective monitoring of automatic systems	x
LO	Define ‘complacency’	x
040 03 07 03	Working concepts	
LO	Summarise how the negative effects of automation on pilots may be alleviated	x
LO	Interpret the role of automation with respect to flight safety	x

AMC6 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES
Subject Meteorology (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR (A) and EIR
050 00 00 00	**METEOROLOGY**	
050 01 00 00	**THE ATMOSPHERE**	
050 01 02 00	**Air temperature**	
050 01 02 04	Lapse rates	
LO	Describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value 0.65°C/100 m or 2°C/1 000 ft and actual values)	x
050 01 02 05	Development of inversions, types of inversions	
LO	Describe development and types of inversions	x
LO	Explain the characteristics of inversions and of an isothermal layer	x
LO	Explain the reasons for the formation of the following inversions:	
— ground inversion (nocturnal radiation/advection), subsidence inversion, frontal inversion, inversion above friction layer, valley inversion	x	
— tropopause inversion		

050 01 02 06	Temperature near the earth's surface, surface effects, diurnal and seasonal variation, effect of clouds, effect of wind	
LO	Describe how the temperature near the earth's surface is influenced by seasonal variations	x
LO	Explain the cooling and warming of the air on the earth or sea surfaces	x
LO	Sketch the diurnal variation of the temperature of the air in relation to the radiation of the sun and of the earth	x
LO	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface	x
LO	Distinguish between the influence of low or high clouds, thick or thin clouds	x
LO	Explain the influence of the wind on the cooling and warming of the air near the surfaces	x
050 01 03 00	**Atmospheric pressure**	
050 01 03 01	Barometric pressure, isobars	
LO	Define atmospheric pressure	x
LO	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches) (Refer to 050 10 01 01)	x
LO	Describe isobars on the surface weather charts	x
LO	Define high, low, trough, ridge, wedge, col	x
050 01 03 02	Pressure variation with height, contours (isohypses)	
LO	Explain the pressure variation with height	x
LO	Describe qualitatively the variation of the barometric lapse rate Note: The average value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa, at about 5500 m/AMSL is 50 ft (15 m) per 1 hPa	x
LO	Describe and interpret contour lines (isohypses) on a constant pressure chart (Refer to 050 10 02 03)	x
050 01 03 03	Reduction of pressure to mean sea level, QFF	
LO	Define QFF	x
LO	Explain the reduction of measured pressure to mean sea level, QFF	x
LO	Mention the use of QFF for surface weather charts	x
050 01 03 04	Relationship between surface pressure centres and pressure centres aloft	

LO	Illustrate with a vertical cross section of isobaric surfaces the relationship between surface pressure systems and upper air pressure systems	x
050 01 04 00	**Air density**	
050 01 04 01	Relationship between pressure, temperature and density	
LO	Describe the relationship between pressure, temperature and density	x
LO	Describe the vertical variation of the air density in the atmosphere	x
LO	Describe the effect of humidity changes on the density of air	x
050 01 05 00	**ICAO Standard Atmosphere (ISA)**	
050 01 05 01	ICAO Standard Atmosphere	
LO	Explain the use of standardised values for the atmosphere	x
LO	List the main values of the ISA (mean sea level pressure, mean sea level temperature, the vertical temperature lapse rate up to 20 km, height and temperature of the tropopause)	x
LO	Calculate the standard temperature in degree Celsius for a given flight level	x
LO	Determine a standard temperature deviation by the difference between the given outside air temperature and the standard temperature	x
050 01 06 00	**Altimetry**	
050 01 06 01	Terminology and definitions	
LO	Define the following terms and abbreviations and explain how they are related to each other: height, altitude, pressure altitude, flight level, level, true altitude, true height, elevation, QNH, QFE and standard altimeter setting	x
LO	Describe the terms transition altitude, transition level, transition layer, terrain clearance, lowest usable flight level	x
050 01 06 03	Calculations	
LO	Calculate the different readings on the altimeter when the pilot changes the altimeter setting	x
LO	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level	x
LO	Derive the reading of the altimeter of an aircraft on the ground when the pilot uses the different settings	x

LO	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two flight levels	x
LO	Explain the influence of pressure areas on the true altitude	x
LO	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation	x
LO	Calculate the terrain clearance and the lowest usable flight level for given atmospheric temperature and pressure conditions	x
	Note: The following rules shall be considered for altimetry calculations: a. All calculations are based on rounded pressure values to the nearest lower hPa b. The value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa c. To determine the true altitude/height the following rule of thumb, called the '4 %-rule', shall be used: the altitude/height changes by 4 % for each 10°C temperature deviation from ISA d. If no further information is given, the deviation of outside air temperature from ISA is considered to be constantly the same given value in the whole layer e. The elevation of the airport has to be taken into account. The temperature correction has to be considered for the layer between ground and the position of the aircraft	
050 01 06 04	Effect of accelerated airflow due to topography	
LO	Describe qualitatively how the effect of accelerated airflow due to topography (Bernoulli effect) affects altimetry	x
050 02 00 00	**WIND**	
050 02 02 00	**Primary cause of wind**	
050 02 02 02	Variation of wind in the friction layer	
LO	Describe why and how the wind changes direction and speed with height in the friction layer in the northern and in the southern hemisphere (rule of thumb)	x

LO	Explain the relationship between isobars and wind (direction and speed) Note: Approximate value for variation of wind in the friction layer (values to be used in examinations):	x

	Type of landscape over water over land WMO-NO. 266	Wind speed in friction layer in % of the geostrophic wind ca 70 % ca 50 %	The wind in the friction layer blows across the isobars towards the low pressure. Angle between wind direction and isobars ca 10° ca 30°	
050 02 02 03	Effects of convergence and divergence			
LO	Describe atmospheric convergence and divergence			x
LO	Explain the effect of convergence and divergence on the following: pressure systems at the surface and aloft; wind speed; vertical motion and cloud formation (relationship between upper air conditions and surface pressure systems)			x
050 02 04 00	**Local winds**			
050 02 04 01	Anabatic and katabatic winds, mountain and valley winds, venturi effects, land and sea breezes			
LO	Describe and explain anabatic and katabatic winds			x
LO	Describe and explain mountain and valley winds			x
LO	Describe and explain the venturi effect, convergence in valleys and mountain areas			x
LO	Describe and explain land and sea breezes, sea breeze front			x
050 02 05 00	**Mountain waves (standing waves, lee waves)**			
050 02 05 01	Origin and characteristics			
LO	Describe and explain the origin and formation of mountain waves			x
LO	State the conditions necessary for the formation of mountain waves			x
LO	Describe the structure and properties of mountain waves			x
LO	Explain how mountain waves may be identified by their associated meteorological phenomena			x
050 02 06 00	Turbulence			
050 02 06 01	Description and types of turbulence			
LO	Describe turbulence and gustiness			x
LO	List common types of turbulence (convective, mechanical, orographic, frontal, clear air turbulence)			x

050 02 06 02	Formation and location of turbulence	
LO	Explain the formation of convective turbulence, mechanical and orographic turbulence, frontal turbulence, clear air turbulence (Refer to 050 02 06 03)	x
LO	State where turbulence will normally be found (rough ground surfaces, relief, inversion layers, CB, TS zones, unstable layers)	x
050 03 00 00	**THERMODYNAMICS**	
050 03 01 00	**Humidity**	
050 03 01 01	Water vapour in the atmosphere	
LO	Describe humid air	x
LO	Describe the significance of water vapour in the atmosphere for meteorology	x
LO	Indicate the sources of atmospheric humidity	x
050 03 01 03	Temperature/dew point, relative humidity	
LO	Define dew point	x
LO	Recognise the dew point curve on a simplified diagram (T,P)	x
LO	Define relative humidity	x
LO	Explain the factors influencing the relative humidity at constant pressure	x
LO	Explain the diurnal variation of the relative humidity	x
LO	Describe the relationship between relative humidity, the amount of water vapour and the temperature	x
LO	Describe the relationship between temperature and dew point	x
LO	Estimate the relative humidity of the air from the difference between dew point and temperature	x
050 04 00 00	**CLOUDS AND FOG**	
050 04 01 00	**Cloud formation and description**	
050 04 01 01	Cloud formation	
LO	Explain cloud formation by adiabatic cooling, conduction, advection and radiation	x
LO	Describe the cloud formation based on the following lifting processes: unorganised lifting in thin layers and turbulent mixing; forced lifting at fronts or over mountains; free convection	x
LO	Determine the cloud base and top in a simplified diagram (temperature, pressure, humidity)	x
LO	Explain the influence of relative humidity on the height of the cloud base	x

LO	Illustrate in a thermodynamic diagram the meaning of convective temperature (temperature at which formation of cumulus starts)	x
LO	List cloud types typical for stable and unstable air conditions	x
LO	Summarise the conditions for the dissipation of clouds	x
050 04 01 02	Cloud types and cloud classification	
LO	Describe cloud types and cloud classification	x
LO	Identify by shape cirriform, cumuliform and stratiform clouds	x
LO	Identify by shape and typical level the ten cloud types (genera)	x
LO	Describe and identify by shape the following species and supplementary feature: castellanus, lenticularis, fractus, humilis, mediocris, congestus, calvus, capillatus and virga	x

LO	Distinguish between low, medium and high level clouds according to the WMO cloud étage (including heights)	
— for mid-latitudes	x	
— for all latitudes		
LO	Distinguish between ice clouds, mixed clouds and pure water clouds	x
050 04 01 03	Influence of inversions on cloud development	
LO	Explain the influence of inversions on vertical movements in the atmosphere	x
LO	Explain the influence of an inversion on the formation of stratus clouds	x
LO	Explain the influence of ground inversion on the formation of fog	x
LO	Determine the top of a cumulus cloud caused by an inversion on a simplified diagram	x
050 04 01 04	Flying conditions in each cloud type	
LO	Assess the ten cloud types for icing and turbulence	x
050 04 02 00	**Fog, mist, haze**	
050 04 02 01	General aspects	
LO	Define fog, mist and haze with reference to WMO standards of visibility range	x
LO	Explain the formation of fog, mist and haze in general	x
LO	Name the factors contributing in general to the formation of fog and mist	x
LO	Name the factors contributing to the formation of haze	x

LO	Describe freezing fog and ice fog	x
050 04 02 02	Radiation fog	
LO	Explain the formation of radiation fog	x
LO	Explain the conditions for the development of radiation fog	x
LO	Describe the significant characteristics of radiation fog, and its vertical extent	x
LO	Summarise the conditions for the dissipation of radiation fog	x
050 04 02 03	Advection fog	
LO	Explain the formation of advection fog	x
LO	Explain the conditions for the development of advection fog	x
LO	Describe the different possibilities of advection fog formation (over land, sea and coastal regions)	x
LO	Describe significant characteristics of advection fog	x
LO	Summarise the conditions for the dissipation of advection fog	x
050 04 02 04	Steam fog	
LO	Explain the formation of steam fog	x
LO	Explain the conditions for the development of steam fog	x
LO	Describe significant characteristics of steam fog	x
LO	Summarise the conditions for the dissipation of steam fog	x
050 04 02 05	Frontal fog	
LO	Explain the formation of frontal fog	x
LO	Explain the conditions for the development of frontal fog	x
LO	Describe significant characteristics of frontal fog	x
LO	Summarise the conditions for the dissipation of frontal fog	x
050 04 02 06	Orographic fog (hill fog)	
LO	Summarise the features of orographic fog	x
LO	Explain the conditions for the development of orographic fog	x
LO	Describe significant characteristics of orographic fog	x
LO	Summarise the conditions for the dissipation of orographic fog	x
050 05 00 00	**PRECIPITATION**	
050 05 01 00	**Development of precipitation**	

050 05 01 01	Process of development of precipitation	
LO	Distinguish between the two following processes by which precipitation is formed	x
LO	— Summarise the outlines of the ice crystal process (Bergeron-Findeisen)	x
LO	— Summarise the outlines of the coalescence process	x
LO	Describe the atmospheric conditions that favour either process	x
LO	Explain the development of snow, rain, drizzle and hail	x
050 05 02 00	**Types of precipitation**	
050 05 02 01	Types of precipitation, relationship with cloud types	
LO	List and describe the types of precipitation given in the TAF and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, freezing rain)	x
LO	State ICAO/WMO approximate diameters for cloud, drizzle and rain drops	x
LO	State approximate weights and diameters for hailstones	x
LO	Explain the mechanism for the formation of freezing precipitation	x
LO	Describe the weather conditions that give rise to freezing precipitation	x
LO	Distinguish between the types of precipitation generated in convective and stratiform cloud	x
LO	Assign typical precipitation types and intensities to different clouds	x
050 06 00 00	**AIR MASSES AND FRONTS**	
050 06 01 00	**Air masses**	
050 06 01 01	Description, classification and source regions of air masses	
LO	Define the term air mass	x
LO	Describe the properties of the source regions	x
LO	Summarise the classification of air masses by source regions	x
LO	State the classifications of air masses by temperature and humidity at source	x
LO	State the characteristic weather in each of the air masses	x
LO	Name the three main air masses that affect Europe	x
LO	Classify air masses on a surface weather chart	x

	Note: Names and abbreviations of air masses used in examinations: — first letter: humidity continental (c), maritime (m) — second letter: type of air mass Arctic (A), Polar (P), Tropical (T), Equatorial (E) — third letter: temperature cold (c), warm (w)	
050 06 01 02	Modifications of air masses	
LO	List the environmental factors that affect the final properties of an air mass	x
LO	Explain how maritime and continental tracks modify air masses	x
LO	Explain the effect of passage over cold or warm surfaces	x
LO	Explain how air mass weather is affected by the season, the air mass track and by orographic and thermal effects over land	x
LO	Assess the tendencies of the stability for an air mass and describe the typical resulting air mass weather including the hazards for aviation	x
050 06 02 00	**Fronts**	
050 06 02 01	General aspects	
LO	Describe the boundaries between air masses (fronts)	x
LO	Define front and frontal surface (frontal zone)	x
050 06 02 02	Warm front, associated clouds and weather	
LO	Define a warm front	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air	x
LO	Explain the seasonal differences in the weather at warm fronts	x
LO	Describe the structure, slope and dimensions of a warm front	x
LO	Sketch a cross-section of a warm front, showing weather, cloud and aviation hazards	x

050 06 02 03	Cold front, associated clouds and weather	
LO	Define a cold front	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air	x
LO	Explain the seasonal differences in the weather at cold fronts	x
LO	Describe the structure, slope and dimensions of a cold front	x
LO	Sketch a cross-section of a cold front, showing weather, cloud and aviation hazards	x
050 06 02 04	Warm sector, associated clouds and weather	
LO	Define fronts and air masses associated with the warm sector	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector	x
LO	Explain the seasonal differences in the weather in the warm sector	x
LO	Sketch a cross-section of a warm sector, showing weather, cloud and aviation hazards	x
050 06 02 05	Weather behind the cold front	
LO	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front	x
LO	Explain the seasonal differences in the weather behind the cold front	x
050 06 02 06	Occlusions, associated clouds and weather	
LO	Define the term occlusion	x
LO	Define a cold occlusion	x
LO	Define a warm occlusion	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion	x
LO	Explain the seasonal differences in the weather at occlusions	x
LO	Sketch a cross-section of cold and warm occlusions, showing weather, cloud and aviation hazards	x
LO	In a sketch plan illustrate the development of an occlusion and the movement of the occlusion point	x
050 06 02 07	Stationary front, associated clouds and weather	

LO	Define a stationary or quasi-stationary front	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a stationary or quasi-stationary front	x
050 06 02 08	Movement of fronts and pressure systems, life cycle	
LO	Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression	x
LO	State the rules for predicting the direction and the speed of movement of fronts	x
LO	Explain the difference between the speed of movement of cold and warm fronts	x
LO	State the rules for predicting the direction and the speed of movement of frontal depressions	x
LO	Describe, with a sketch if required, the genesis, development and life cycle of a frontal depression with associated cloud and rain belts	x
050 06 02 09	Changes of meteorological elements at a frontal wave	
LO	Sketch a plan and a cross-section of a frontal wave (warm front, warm sector and cold front) and illustrate the changes of pressure, temperature, surface wind and wind in the vertical axis	x
050 07 00 00	**PRESSURE SYSTEMS**	
050 07 02 00	**Anticyclone**	
050 07 02 01	Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence	
LO	List the different types of anticyclones	x
LO	Describe the effect of high level convergence in producing areas of high pressure at ground level	x
LO	Describe air mass subsidence, its effect on the environmental lapse rate, and the associated weather	x
LO	Describe the formation of warm and cold anticyclones	x
LO	Describe the formation of ridges and wedges (Refer to 050 08 03 02)	x
LO	Describe the properties of and the weather associated with warm and cold anticyclones	x
LO	Describe the properties of and the weather associated with ridges and wedges	x
LO	Describe the blocking anticyclone and its effects	x
050 07 03 00	**Non frontal depressions**	

050 07 03 01	Thermal-, orographic-, polar- and secondary depressions, troughs	
LO	Describe the effect of high level divergence in producing areas of low pressure at ground level	x
LO	Describe the formation and properties of thermal-, orographic- (lee lows), polar- and secondary depressions	x
LO	Describe the formation, the properties and the associated weather of troughs	x
050 08 00 00	**CLIMATOLOGY**	
050 08 03 00	**Typical weather situations in the mid-latitudes**	
050 08 03 01	Westerly situation (westerlies)	
LO	Identify on a weather chart the typical westerly situation with travelling polar front waves	x
LO	Describe the typical weather in the region of the travelling polar front waves including the seasonal variations	x
050 08 03 02	High pressure area	
LO	Describe the high pressure zones with the associated weather	x
LO	Identify on a weather chart high pressure regions	x
LO	Describe the weather associated with wedges in the polar air (Refer to 050 07 02 01)	x
050 08 03 03	Flat pressure pattern	
LO	Identify on a surface weather chart the typical flat pressure pattern	x
LO	Describe the weather associated with a flat pressure pattern	x
050 09 00 00	**FLIGHT HAZARDS**	
050 09 01 00	**Icing**	
050 09 01 01	Conditions for ice accretion	
LO	Summarise the general conditions under which ice accretion occurs on aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle; possibility of sublimation)	x
LO	Indicate the general weather conditions under which ice accretion in venturi carburettor occurs	x
LO	Explain the general weather conditions under which ice accretion on airframe occurs	x
LO	Explain the formation of supercooled water in clouds, rain and drizzle (Refer to 050 03 02 01)	x

LO	Explain qualitatively the relationship between the air temperature and the amount of supercooled water	x
LO	Explain qualitatively the relationship between the type of cloud and the size and number of the droplets, in cumuliform and stratiform clouds	x
LO	Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation	x
LO	Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, outside clouds and precipitation	x
LO	Describe the different factors influencing the intensity of icing: air temperature, amount of supercooled water in a cloud or in precipitation, amount of ice crystals in the air, speed of the aircraft, shape (thickness) of the airframe parts (wings, antennas, etc)	x
LO	Explain the effects of topography on icing	x
LO	Explain the higher concentration of water drops in stratiform orographic clouds	x
050 09 01 02	Types of ice accretion	
LO	Define clear ice	x
LO	Describe the conditions for the formation of clear ice	x
LO	Explain the formation of the structure of clear ice with the release of latent heat during the freezing process	x
LO	Describe the aspect of clear ice: appearance, weight, solidity	x
LO	Define rime ice	x
LO	Describe the conditions for the formation of rime ice	x
LO	Describe the aspect of rime ice: appearance, weight, solidity	x
LO	Define mixed ice	x
LO	Describe the conditions for the formation of mixed ice	x
LO	Describe the aspect of mixed ice: appearance, weight, solidity	x
LO	Describe the possible process of ice formation in snow conditions	x
LO	Define hoar frost	x
LO	Describe the conditions for the formation of hoar frost	x
LO	Describe the aspect of hoar frost: appearance, solidity	x
050 09 01 03	Hazards of ice accretion, avoidance	
LO	State the ICAO qualifying terms for the intensity of icing (See ICAO ATM Doc 4444)	x

LO	Describe, in general, the hazards of icing	x
LO	Assess the dangers of the different types of ice accretion	x
LO	Describe the position of the dangerous zones of icing in fronts, in stratiform and cumuliform clouds and in the different precipitation types	x
LO	Indicate the possibilities of avoidance — in the flight planning: weather briefing, choice of track and altitude — during flight: recognition of the dangereous zones, choice of appropriate track and altitude	x
050 09 02 00	**Turbulence**	
050 09 02 01	Effects on flight, avoidance	
LO	State the ICAO qualifying terms for the intensity of turbulence (See ICAO ATM Doc 4444)	x
LO	Describe the effects of turbulence on an aircraft in flight	x
LO	Indicate the possibilities of avoidance — in the flight planning: weather briefing, choice of track and altitude — during flight: choice of appropriate track and altitude	x
050 09 03 00	**Wind shear**	
050 09 03 01	Definition of wind shear	
LO	Define wind shear (vertical and horizontal)	x
LO	Define low level wind shear	x
050 09 03 02	Weather conditions for wind shear	
LO	Describe conditions where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief)	x
050 09 03 03	Effects on flight, avoidance	
LO	Describe the effects on flight caused by wind shear	x
LO	Indicate the possibilities of avoidance — in the flight planning — during flight	x
050 09 04 00	**Thunderstorms**	
050 09 04 01	Conditions for and process of development, forecast, location, type specification	
LO	Name the cloud types which indicate the development of thunderstorms	x

LO	Describe the different types of thunderstorms, their location, the conditions for and the process of development and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms)	x
050 09 04 02	Structure of thunderstorms, life history	
LO	Describe and sketch the stages of the life history of a thunderstorm: initial, mature and dissipating stage	x
LO	Assess the average duration of thunderstorms and their different stages	x
LO	Describe supercell storm: initial, supercell, tornado and dissipating stage	x
LO	Summarise the flight hazards of a fully developed thunderstorm	x
LO	Indicate on a sketch the most dangerous zones in and around a thunderstorm	x
050 09 04 03	Electrical discharges	
LO	Describe the basic outline of the electric field in the atmosphere	x
LO	Describe the electrical potential differences in and around a thunderstorm	x
LO	Describe and asses 'St. Elmo's fire'	x
LO	Describe the development of lightning discharges	x
LO	Describe the effect of lightning strike on aircraft and flight execution	x
050 09 04 04	Development and effects of downbursts	
LO	Define the term downburst	x
LO	Distinguish between macroburst and microburst	x
LO	State the weather situations leading to the formation of downbursts	x
LO	Describe the process of development of a downburst	x
LO	Give the typical duration of a downburst	x
LO	Describe the effects of downbursts	x
050 09 04 05	Thunderstorm avoidance	
LO	Explain how the pilot can anticipate each type of thunderstorms: pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar and by airborne weather radar (Refer to 050 10 01 04), use of the stormscope (lightning detector)	x
LO	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms	x
050 09 05 00	**Tornadoes**	

050 09 05 01	Properties and occurrence	
LO	Define the tornado	x
050 09 06 00	**Inversions**	
050 09 06 01	Influence on aircraft performance	
LO	Explain the influence of inversions on the aircraft performance	x
LO	Compare the flight hazards during take-off and approach associated to a strong inversion alone and to a strong inversion combined with marked wind shear	x
050 09 08 00	**Hazards in mountainous areas**	
050 09 08 01	Influence of terrain on clouds and precipitation, frontal passage	
LO	Describe the influence of a mountainous terrain on cloud and precipitation	x
LO	Describe the effects of the Foehn	x
LO	Describe the influence of a mountainous area on a frontal passage	x
050 09 08 02	Vertical movements, mountain waves, wind shear, turbulence, ice accretion	
LO	Describe the vertical movements, wind shear and turbulence typical of mountain areas	x
LO	Indicate in a sketch of a chain of mountains the turbulent zones (mountain waves, rotors)	x
LO	Explain the influence of relief on ice accretion	x
050 09 08 03	Development and effect of valley inversions	
LO	Describe the formation of valley inversion due to the katabatic winds	x
LO	Describe the valley inversion formed by warm winds aloft	x
LO	Describe the effects of a valley inversion for an aircraft in flight	x
050 09 09 00	**Visibility reducing phenomena**	
050 09 09 01	Reduction of visibility caused by precipitation and obscurations	
LO	Describe the reduction of visibility caused by precipitation: drizzle, rain, snow	x
LO	Describe the reduction of visibility caused by obscurations: — fog, mist, haze, smoke, volcanic ash — sand (SA), dust (DU)	x
LO	Describe the differences between the ground visibility, flight visibility, slant visibility and vertical visibility when an aircraft is above or within a layer of haze or fog	x
050 09 09 02	Reduction of visibility caused by other phenomena	

LO	Describe the reduction of visibility caused by — low drifting and blowing snow — low drifting and blowing dust and sand — duststorm (DS) and sandstorm (SS) — icing (windshield) — the position of the sun relative to the visual direction — the reflection of sun's rays from the top of layers of haze, fog and clouds	x
050 10 00 00	**METEOROLOGICAL INFORMATION**	
050 10 01 00	**Observation**	
050 10 01 01	Surface observations	
LO	Define visibility	x
LO	Describe the mereorological measurement of visibility	x
LO	Define prevailing visibility	x
LO	Define ground visibility	x
LO	List the units used for visibility (m, km)	x
LO	Define runway visual range	x
LO	Describe the meteorological measurement of runway visual range	x
LO	Indicate where the transmissometers/forward-scatter meters are placed on the airport	x
LO	List the units used for runway visual range (m)	x
LO	List the different possibilities to transmit information about runway visual range to pilots	x
LO	Compare visibility and runway visual range	x
LO	List the clouds considered in meteorological reports, and how they are indicated in METARs (TCU, CB)	x
LO	Define oktas	x
LO	Define cloud base	x
LO	Define ceiling	x
LO	Name the unit and the reference level used for information about cloud base (ft)	x
LO	Define vertical visibility	x

LO	Explain briefly how and when the vertical visibility is measured	x
LO	Name the unit used for vertical visibility (ft)	x
050 10 01 04	Weather radar observations	
LO	Interpret ground weather radar images	x
LO	Describe the basic principle and the type of information given by airborne weather radar	x
LO	Describe the limits and the errors of airborne weather radar information	x
LO	Interpret typical airborne weather radar images	x
050 10 02 00	**Weather charts**	
050 10 02 01	Significant weather charts	
LO	Decode and interpret significant weather charts (low, medium and high level)	x
LO	Describe from a significant weather chart the flight conditions at designated locations and/or along a defined flight route at a given flight level	x
050 10 02 02	Surface charts	
LO	Recognize the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high and low pressure areas	x
050 10 03 00	**Information for flight planning**	
050 10 03 01	Aviation weather messages	
LO	Describe, decode and interpret the following aviation weather messages (given in written and/or graphical format): METAR, SPECI, TREND, TAF, SIGMET, AIRMET, GAMET, special air-report, volcanic ash advisory information	x
LO	Describe the general meaning of MET REPORT and SPECIAL	x
LO	List, in general, the cases when a SIGMET and an AIRMET are issued	x
LO	Describe, decode (by using a code table) and interpret the following messages: Runway State Message (as written in a METAR), GAFOR	x
	Note: For Runway State Message and GAFOR refer to Air Navigation Plan European Region ICAO Doc 7754	
050 10 03 02	Meteorological broadcasts for aviation	

LO	Describe the meteorological content of broadcasts for aviation: — VOLMET, ATIS — HF-VOLMET	x

050 10 03 03	Use of meteorological documents	
LO	Describe meteorological briefing and advice	x
LO	List the information that a flight crew can receive from meteorological services for pre-flight planning and apply the content of these information on a designated flight route	x
LO	List the meteorological information that a flight crew can receive from services during flight and apply the content of these information for the continuation of the flight	x
050 10 03 04	Meteorological warnings	
LO	Describe and interpret aerodrome warnings and wind shear warnings and alerts	x

AMC7 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Radio Navigation (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR (A) and EIR
062 00 00 00	**RADIO NAVIGATION**	
062 02 00 00	**RADIO AIDS**	
062 02 01 00	**Ground D/F**	
062 02 01 03	Coverage and range	
LO	Use the formula, 1,23 x √transmitter height in feet + 1,23 x √receiver height in feet, to calculate the range in NM	x
062 02 02 00	**NDB/ADF**	
062 02 02 01	Principles	
LO	Define the abbreviation NDB Non Directional Beacon	x
LO	Define the abbreviation ADF Automatic Direction Finder	x
LO	State that the NDB is the ground part of the system	x
LO	State that the ADF is the airborne part of the system	x
LO	State that NDB operates in the LF and MF frequency bands	x
LO	The frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is	x

	190–1750 kHz	
LO	Define a locator beacon. An LF/MF NDB used as an aid to final approach usually with a range, according to ICAO Annex 10, of 10–25 NM	x
LO	Explain the difference between NDBs and locator beacons	x
LO	Explain which beacons transmit signals suitable for use by an ADF	x
LO	State that certain commercial radio stations transmit within the frequency band of the NDB	x
LO	Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave	x
LO	Describe the use of NDBs for navigation	x
LO	Describe the procedure to identify an NDB station	x
LO	Interpret the term ‘cone of silence’ in respect of an NDB	x
LO	State that an NDB station emits a N0N/A1A or a NON/A2A signal	x
LO	State the function of the BFO (Beat Frequency Oscillator)	x
LO	State that in order to identify a NON/A1A NDB, the BFO circuit of the receiver has to be activated	x
LO	State that the NDB emitting NON/A1A gives rise to erratic indications of the bearing while the station is identifying	x
LO	Explain that on modern aircraft the BFO is activated automatically	x
062 02 02 02	Presentation and interpretation	
LO	Name the types of indicator in common use: — Electronic navigation display — Radio Magnetic Indicator RMI — Fixed card ADF (radio compass) — Moving card ADF	x
LO	Describe the indications given on RMI, fixed card and moving card ADF displays	x
LO	Given a display interpret the relevant ADF information	x
LO	Calculate the true bearing from the compass heading and relative bearing	x
LO	Convert the compass bearing into magnetic bearing and true bearing	x

LO	Describe how to fly the following in-flight ADF procedures according to Doc 8168 Vol. 1: — Homing and tracking and explain the influence of wind — Interceptions — Procedural turns — Holding patterns	x
062 02 02 03	Coverage and range	
LO	State that the power limits the range of an NDB	x
LO	State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land	x
LO	Describe the propagation path of NDB radio waves with respect to the ionosphere and the Earth’s surface	x
LO	Explain that interference between sky and ground waves at night leads to ‘fading’	x
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established during approach according to ICAO DOC 8168 as within ± 5°	x
LO	State that there is no warning indication of NDB failure	x
062 02 02 04	Errors and accuracy	
LO	Explain Coastal Refraction. As a radio wave travelling over land crosses the coast, the wave speeds up over water and the wave front bends	x
LO	Define Night/twilight effect. The influence of sky waves and ground waves arriving at the ADF receiver with a difference of phase and polarisation which introduce bearing errors	x
LO	State that interference from other NDB stations on the same frequency may occur at night due to sky wave contamination	x
062 02 02 05	Factors affecting range and accuracy	
LO	State that there is no coastal refraction error when: — The propagation direction of the wave is 90° to the coast line — The NDB station is sited on the coast line	x
LO	State that coastal refraction error increases with increased incidence.	x
LO	State that night effect predominates around dusk and dawn.	x

LO	Define multipath propagation of the radio wave (mountain effect).	x
LO	State that static emission energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.	x
062 02 03 00	**VOR and Doppler-VOR**	
062 02 03 01	Principles	
LO	State that the frequency band allocated to VOR according to ICAO Annex 10 is VHF and the frequencies used are 108.0–117.975 MHz.	x
LO	State that frequencies in the allocated VOR range with the first decimal place an odd number, are used by ILS	x
LO	State that the following types of VOR are in operation: — Conventional VOR (CVOR) a first generation VOR station emitting signals by means of a rotating antenna — Doppler VOR (DVOR) a second generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle — En-route VOR for use by IFR traffic — Terminal VOR (TVOR) a station with a shorter range used as part of the approach and departure structure at major airports — Test VOR (VOT) a VOR station emitting a signal to test VOR indicators in an aircraft	x
LO	Describe how ATIS information is transmitted on VOR frequencies.	x
LO	List the three main components of VOR airborne equipment: — The antenna — The receiver — The indicator	x
LO	Describe the identification of a VOR in terms of Morse-code letters, continuous tone or dots (VOT), tone pitch, repetition rate and additional plain text	x
LO	State that failure of the VOR station to stay within the required limits can cause the removal of identification and navigation components from the carrier or radiation to cease	x
062 02 03 02	Presentation and interpretation	
LO	Read off the radial on a Radio Magnetic Indicator (RMI)	x

LO	Read off the angular displacement, in relation to a pre-selected radial on an HSI or CDI	x
LO	Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR considering also the heading of the aircraft	x
LO	Interpret VOR information as displayed on HSI, CDI and RMI	x
LO	Describe the following in-flight VOR procedures as in DOC 8168 Vol.1: — Tracking and explain the influence of wind when tracking — Interceptions — Procedural turns — Holding patterns	x
LO	State that when converting a radial into a true bearing, the variation at the VOR station has to be taken into account	x
062 02 03 03	Coverage and Range	
LO	Calculate the range using the formula: 1,23 x √transmitter height in feet + 1,23 x √receiver height in feet	x
062 02 03 04	Errors and accuracy	
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established on a VOR track when flying approach procedures according to ICAO Doc 8168 as within half full scale deflection of the required track	x
LO	State that due to reflections from terrain, radials can be bent and lead to wrong or fluctuating indications which is called ‘scalloping’.	x
062 02 04 00	**DME**	
062 02 04 01	Principles	
LO	State that DME operates in the UHF band between 960–1215 MHz according to ICAO Annex 10	x
LO	State that the system comprises two basic components: — The aircraft component, the interrogator — The ground component, the transponder	x
LO	State that the distance measured by DME is slant range	x
LO	Illustrate that a position line using DME is a circle with the station at its centre	x

LO	Describe how the pairing of VHF and UHF frequencies (VOR/DME) enables selection of two items of navigation information from one frequency setting	x
LO	Describe, in the case of co-location, the frequency pairing and identification procedure	x
LO	Explain that depending on the configuration, the combination of a DME distance with a VOR radial can determine the position of the aircraft	x
LO	Explain that military TACAN stations may be used for DME information	x
062 02 04 02	Presentation and interpretation	
LO	Explain that when identifying a DME station co-located with a VOR station, the identification signal with the higher tone frequency is the DME which idents approximately every 40 seconds	x
LO	Calculate ground distance given slant range and altitude	x
LO	Describe the use of DME to fly a DME arc in accordance with DOC 8168 Vol. 1	x
LO	State that a DME system may have a groundspeed read out combined with the DME read out	x
062 02 04 03	Coverage and Range	
LO	Explain why a ground station can generally respond to a maximum of 100 aircraft.	x
LO	Explain which aircraft will be denied a DME range first when more than 100 interrogations are being made	x
062 02 04 05	Factors affecting range and accuracy	
LO	State that the groundspeed read out combined with DME is only correct when tracking directly to or from the DME station	x
LO	State that, close to the station, the groundspeed read out combined with DME is less than the actual groundspeed	x
062 02 05 00	**ILS**	
062 02 05 01	Principles	
LO	Name the three main components of an ILS: — The localiser (LLZ) — The glide path (GP) — Range information (markers or DME)	x

LO	State the site locations of the ILS components: — The localiser antenna should be located on the extension of the runway centre line at the stop-end — The glide path antenna should be located 300 metres beyond the runway threshold, laterally displaced approximately 120 metres to the side of the runway centre line	x
LO	Explain that marker beacons produce radiation patterns to indicate predetermined distances from the threshold along the ILS glide path	x
LO	Explain that marker beacons are sometimes replaced by a DME paired with the LLZ frequency	x
LO	State that in the ILS frequency assigned band 108,0–111,975 MHz, only frequencies with the first decimal odd are ILS frequencies	x
LO	State that the LLZ operates in the VHF band 108,0–111,975 MHz according to ICAO Annex 10	x
LO	State that the GP operates in the UHF band	x
LO	State that both the LLZ and the GP antenna radiate side lobes (false beams) which could give rise to false centreline and false glide path indication	x
LO	Explain that the back beam from the LLZ antenna may be used as a published 'non-precision approach'	x
LO	State that according to ICAO Annex 10 the nominal glide path is 3°	x
LO	State that according to ICAO DOC 8168, the final approach area contains a fix or facility that permits verification of the ILS glide path/altimeter relationship. The outer marker or DME is usually used for this purpose.	x
062 02 05 02	Presentation and interpretation	
LO	Describe the ILS identification regarding frequency and Morse code and/or plain text	x
LO	Calculate the rate of descent for a 3° glide path angle given the groundspeed of the aircraft using the formula: Rate of descent (ROD) in ft/min = groundspeed in kt x 10 2	x
LO	Calculate the rate of descent using the following formula when flying any glide path angle: ROD ft/min = Speed factor (SF) x glide path angle x 100	x

LO	Interpret the markers by sound, modulation, and frequency	x
LO	State that the outer marker cockpit indicator is coloured blue, the middle marker amber and the inner marker white	x
LO	State that a failure of either the LLZ or the GP to stay within predetermined limits will cause: — Removal of identification and navigation components from the carrier — Radiation to cease — A warning to be displayed at the designated control point	x
LO	State that an ILS receiver has an automatic monitoring function	x
LO	Interpret the indications on a Course Deviation Indicator (CDI) and a Horizontal Situation Indicator (HSI): — Full scale deflection of the CDI needle corresponds to approximately 2,5° displacement from the ILS centre line — Full scale deflection on the GP corresponds to approximately 0,7° from the ILS GP centre line	x
LO	Interpret the aircraft's position in relation to the extended runway centre line on a back-beam approach	x
LO	Explain the setting of the course pointer of an HSI for front-beam and back-beam approaches	x
062 02 05 03	Coverage and Range	
LO	Sketch the standard coverage area of the LLZ and GP with angular sector limits in degrees and distance limits from the transmitter in accordance with ICAO Annex 10: — LLZ coverage area is 10° on either side of the centre line to a distance of 25 NM from the runway, and 35° on either side of the centre line to a distance of 17 NM from the runway — GP coverage area is 8° on either side of the centre line to a distance of minimum 10 NM from the runway	x
062 02 05 04	Errors and accuracy	
LO	Explain that ILS approaches are divided into facility performance categories defined in ICAO Annex 10	x
LO	Explain the following in accordance with ICAO DOC 8168: — The accuracy the pilot has to fly the ILS localiser to be considered established on an ILS track is within half full scale deflection of the required track	x

	— The aircraft has to be established within half scale deflection of the LLZ before starting descent on the GP — The pilot has to fly the ILS GP to a maximum of half scale fly-up deflection of the GP in order to stay in protected airspace	
LO	State that if a pilot deviates by more than half scale deflection on the LLZ or by more than half course fly-up deflection on the GP, an immediate missed approach should be executed, because obstacle clearance may no longer be guaranteed	x
062 03 00 00	**RADAR**	
062 03 01 00	**Pulse techniques and associated terms**	
LO	Name the different applications of radar with respect to ATC, MET observations and airborne weather radar	x
LO	Describe the pulse technique and echo principle on which primary radar systems are based.	x
LO	Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display: — Atmospheric conditions; super refraction and sub refraction — Attenuation with distance — Condition and size of the reflecting surface	x
062 03 02 00	**Ground Radar**	
062 03 02 01	Principles	
LO	Explain that primary radar provides bearing and distance of targets.	x
LO	Explain that primary ground radar is used to detect aircraft that are not equipped with a secondary radar transponder.	x
LO	Explain why Moving Target Indicator (MTI) is used	x
062 03 02 02	Presentation and interpretation	
LO	State that modern ATC systems use computer generated display.	x
LO	Explain that the radar display enables the ATS controller to provide information, surveillance or guidance service.	x
062 03 03 00	**Airborne Weather Radar**	
062 03 03 01	Principles	
LO	List the two main tasks of the weather radar in respect of weather and navigation	x

LO	Explain how the antenna is attitude-stabilised in relation to the horizontal plane using the aircraft's attitude reference system	x
LO	Describe the cone shaped pencil beam of about 3° to 5° beam width used for weather depiction	x
LO	Explain that in modern AWRs a single radiation pattern is used for both mapping and weather with the scanning angle being changed between them	x
062 03 03 02	Presentation and interpretation	
LO	Explain the functions of the following different modes on the radar control panel — Off/on switch — Function switch, with modes WX, WX+T and MAP. — Gain control setting (auto/manual) — Tilt/auto tilt switch.	x
LO	Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red and magenta) indicating the increasing intensity of precipitation	x
LO	Illustrate the use of azimuth marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm or to a landmark on the screen	x
062 03 03 03	Coverage and Range	
LO	Explain how the radar is used for weather detection and for mapping (range, tilt and gain if available)	x
062 03 03 04	Errors, accuracy, limitations	
LO	Explain why AWR should be used with extreme caution when on the ground	x
062 03 03 05	Factors affecting range and accuracy	
LO	Explain the danger of the area behind heavy rain (shadow area) where no radar waves will penetrate	x
LO	Explain why the tilt setting should be higher when the aircraft descends to a lower altitude	x
LO	Explain why the tilt setting should be lower when the aircraft climbs to a higher altitude	x
LO	Explain why a thunderstorm may not be detected when the tilt is set too high	x

062 03 03 06	Application for navigation	
LO	Describe the navigation function of the radar in the mapping mode	x
LO	Describe the use of the weather radar to avoid a thunderstorm (Cb)	x
LO	Explain how turbulence (not CAT) can be detected by a modern weather radar	x
LO	Explain how wind shear can be detected by a modern weather radar	x
062 03 04 00	**Secondary Surveillance Radar and transponder**	
062 03 04 01	Principles	
LO	Explain that the Air Traffic Control (ATC) system is based on the replies provided by the airborne transponders in response to interrogations from the ATC secondary radar	x
LO	Explain that the ground ATC secondary radar uses techniques which provide the ATC with information that cannot be acquired by primary radar	x
LO	Explain that an airborne transponder provides coded reply signals in response to interrogation signals from the ground secondary radar and from aircraft equipped with TCAS.	x
LO	Explain the advantages of SSR over a primary radar	x
062 03 04 02	Modes and codes	
LO	Explain that the interrogator transmits its interrogations in the form of a series of pulses.	x
LO	Name and explain the Interrogation modes: 1. Mode A and C 2. Intermode: Mode A/C/S all call Mode A/C only all call 3. Mode S: Mode S only all call Broadcast (no reply elicited) Selective	x

LO	State that Mode A designation is a sequence of four digits can be manually selected from 4096 available codes.	x
LO	State that in mode C reply the pressure altitude is reported in 100 ft increments.	x
LO	State that in addition to the information pulses provided, a special position identification pulse (SPI) can be transmitted but only as a result of a manual selection (IDENT)	x
LO	Explain the need for compatibility of Mode S with Mode A and C	x
LO	Explain that the Mode S transponders receive interrogations from other Mode S transponders and SSR ground stations	x
LO	State that Mode S surveillance protocols implicitly use the principle of selective addressing	x
LO	Explain that every aircraft will have been allocated an ICAO Aircraft Address which is hard coded into the airframe (Mode S address)	x
LO	Interpret the following mode S terms: — Selective addressing — Mode 'all call' — Selective call	x
LO	State that Mode S interrogation contains either: — Aircraft address — All-call address — Broadcast address	x
LO	State that the Aircraft Address shall be transmitted in any reply except in Mode S only all-call reply	x
062 03 04 03	Presentation and interpretation	
LO	Explain how an aircraft can be identified by a unique code	x
LO	Illustrate how the following information is presented on the radar screen: — Pressure altitude — Flight level — Flight number or aircraft registration — Ground speed	x
LO	Name and interpret the codes 7700, 7600 and 7500	x

LO	Interpret the selector modes: OFF, Standby, ON (mode A), ALT (mode A and C) and TEST	x
LO	Explain the function of the emission of a SPI (Special Position Identification) pulse after pushing the IDENT button in the aircraft	x
ELEMENTARY SURVEILLANCE		
LO	Explain that the elementary surveillance provides the ATC controller with aircraft position, altitude and identification	x
LO	State that the elementary surveillance needs MODE S transponders with surveillance identifier (SI) code capacity and the automatic reporting of aircraft identification, known as ICAO level 2s	x
LO	State that the SI code must correspond to the aircraft identification specified in item 7 of the ICAO flight plan or to the registration marking	x
062 03 04 04	Errors and Accuracy	
LO	Explain the following disadvantages of SSR (mode A/C): — Code garbling of aircraft less than 1.7 NM apart measured in the vertical plane perpendicular to and from the antenna — 'Fruiting' which results from reception of replies caused by interrogations from other radar stations	x
062 05 00 00	**AREA NAVIGATION SYSTEMS, RNAV/FMS**	

		Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
'062 07 00 00	**PBN**						
062 07 01 00	**PBN concept (as described in ICAO Doc 9613)**						
062 07 01 01	PBN principles						
LO	List the factors used to define RNAV or RNP system performance requirements (accuracy, integrity, continuity and functionality).	x		x			x
LO	Explain the concept of continuity.	x		x			x

LO	Explain the concept of integrity.	x		x			x
LO	State that, unlike conventional navigation, performance-based navigation is not sensor-specific.	x		x			x
LO	Explain the difference between raw data and computed data.						
062 07 01 02	PBN components						
LO	List the components of PBN as NAVAID infrastructure, navigation specification and navigation application.	x		x			x
LO	Identify the components from an example.	x		x			x
062 07 01 03	PBN scope						
LO	State that in oceanic/remote, en route and terminal phases of flight PBN is limited to operations with linear lateral performance requirements and time constraints.	x		x			x
LO	State that in the approach phases of flight PBN accommodates both linear and angular laterally guided operations.	x		x			x
062 07 02 00	**Navigation specifications**						
062 07 02 01	RNAV and RNP						
LO	State the difference between RNAV and RNP in terms of the requirement for on-board performance monitoring and alerting.	x		x			x
062 07 02 02	Navigation functional requirements						

LO	List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, g/s or time to active waypoint, navigation data storage and failure indication).	x		x			x
062 07 02 03	Designation of RNP and RNAV specifications						
LO	Interpret “X” in RNAV X or RNP X as the lateral navigation accuracy (total system error) in nautical miles, which is expected to be achieved at least 95 per cent of the flight time by the population of aircraft operating within the airspace, route or procedure.	x		x			x
LO	State that aircraft approved to the more stringent accuracy requirements may not necessarily meet some of the functional requirements of the navigation specification having a less stringent accuracy requirement.	x		x			x
LO	State that RNAV10 and RNP4 are used in the oceanic/remote phase of flight.	x		x			x
LO	State that RNAV5 is used in the en route and arrival phase of flight.	x		x			x
LO	State that RNAV2 and RNP2 are also used as navigation specifications.	x		x			x
LO	State that RNP2 is used in the en route and oceanic/remote phases of flight.	x		x			x

LO	State that RNAV1 and RNP1 are used in the arrival and departure phases of flight.	x		x			x
LO	State that RNP APCH is used in the approach phase of flight.	x		x			x
LO	State that RNP AR APCH is used in the approach phase of flight.	x		x			x
LO	State that RNP 0.3 navigation specification is used in all phases of flight, except for oceanic/remote and final approach, primarily for helicopters.	x		x			x
062 07 03 00	**Use of PBN**						
062 07 03 01	Airspace planning						
LO	State that navigation performance is one factor used to determine minimum route spacing.	x		x			x
062 07 03 02	Approval						
LO	State that the airworthiness approval process assures that each item of the area navigation equipment installed is of a type and design appropriate to its intended function and that the installation functions properly under foreseeable operating conditions.	x		x			x
LO	State that some PBN specifications require operational approval.	x		x			x
062 07 03 03	Specific RNAV and RNP system functions						
LO	Recognise the definition of an RF leg.	x		x			x
LO	Recognise the definition of a fixed radius transition.	x		x			x

LO	Recognise the definition of a fly-by-turn and a fly-over.	x		x			x
LO	Recognise the definition of a holding pattern.	x		x			x
LO	Recognise the definition of an “ARINC 424 path terminator”.	x		x			x
LO	Recognise the definition of the following path terminators: IF, TF, CF, DF, FA, CA.	x		x			x
LO	Recognise the definition of an offset flight path.	x		x			x
062 07 03 04	Data processes						
LO	State that the safety of the application is contingent upon the accuracy, resolution and integrity of the data.	x		x			x
LO	State that the accuracy of the data depends upon the processes applied during data origination.	x		x			x
062 07 04 00	**PBN operations**						
062 07 04 01	PBN principles						
LO	Recognise the definition of path definition error.	x		x			x
LO	Recognise the definition of flight technical error.	x		x			x
LO	Recognise the definition of navigation system error.	x		x			x
LO	Recognise the definition of total system error.	x		x			x
062 07 04 02	On-board performance monitoring and alerting						
LO	State that on-board performance monitoring and alerting of flight technical error is managed by on-board systems or crew procedures.	x		x			x

LO	State that on-board performance monitoring and alerting of navigation system error is a requirement of on-board equipment for RNP.	x		x			x
LO	State that on-board performance monitoring and alerting of path definition error are managed by gross reasonableness checks of navigation data.	x		x			x
062 07 04 03	Abnormal situations						
LO	State that abnormal and contingency procedures are to be used in case of loss of the PBN capability.	x		x			x
062 07 04 04	Database management						
LO	State that, unless otherwise specified in operations documentation or AMC, the navigational database must be valid for the current AIRAC cycle.	x		x			x
062 07 05 00	**Requirements of specific RNAV and RNP specifications**						
062 07 05 01	RNAV10						
LO	State that RNAV10 requires that aircraft operating in oceanic and remote areas be equipped with at least two independent and serviceable LRNSs comprising an INS, an IRS FMS or a GNSS.	x		x			x

LO	State that aircraft incorporating dual inertial navigation systems (INS) or inertial reference units (IRU) have a standard time limitation.	x		x			x
LO	State that operators may extend their RNAV10 navigation capability time by updating.	x		x			x
062 07 05 02	RNAV5						
LO	State that manual data entry is acceptable for RNAV5.	x		x			x
062 07 05 03	RNAV/RNP1/2						
LO	State that pilots must not fly an RNAV/RNP1/2 SID or STAR unless it is retrievable by route name from the on-board navigation database and conforms to the charted route.	x		x			x
LO	State that the route may subsequently be modified through the insertion (from the database) or deletion of specific waypoints in response to ATC clearances.	x		x			x
LO	State that the manual entry, or creation of new waypoints by manual entry, of latitude and longitude or place/bearing/ distance values is not permitted.	x		x			x
062 07 05 04	RNP4						
LO	State that at least two LRNSs, capable of navigating to RNP4 and listed in the flight manual, must be operational at the entry point of the RNP airspace.	x		x			x
062 07 05 05	RNP APCH						

LO	State that pilots must not fly an RNP APCH unless it is retrievable by procedure name from the on-board navigation database and conforms to the charted procedure.	x		x			x
LO	State that an RNP APCH to LNAV minima is a non-precision instrument approach procedure designed for 2D approach operations.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima has lateral guidance based on GNSS and vertical guidance based on either SBAS or BaroVNAV.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima may only be conducted with vertical guidance certified for the purpose.	x		x			x
LO	Explain why an RNP APCH to LNAV/VNAV minima based on BaroVNAV may only be conducted when the aerodrome temperature is within a promulgated range.	x		x			x
LO	State that the correct altimeter setting is critical for the safe conduct of an RNP APCH using BaroVNAV.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima is a 3D operation.	x		x			x
LO	State that an RNP APCH to LPV minima is a 3D operation.	x		x			x
LO	State that RNP APCH to LPV minima requires an FAS data-block.	x		x			x
062 07 05 06	RNP AR APCH						

LO	State that RNP AR APCH requires authorisation.	x		x			x
062 07 05 07	A-RNP						
LO	State that Advanced RNP incorporates the navigation specifications RNAV5, RNAV2, RNAV1, RNP2, RNP1 and RNP APCH.	x		x			x
LO	State that Advanced RNP may be associated with other functional elements.	x		x			x
062 07 05 08	PBN Point in Space (PinS) departure						
LO	State that a PinS departure is a departure procedure designed for helicopters only.			x			x
LO	State that a PinS departure procedure includes either a “proceed VFR” or a “proceed visually” instruction from landing location to IDF.			x			x
LO	Recognise the differences between “proceed VFR” and “proceed visually” instruction.			x			x
062 07 05 09	PBN Point in Space (PinS) approach						
LO	State that a PinS approach is an instrument RNP APCH procedure designed for helicopters only, and that may be published with LNAV minima or LPV minima.			x			x
LO	State that a PinS approach procedure includes either a “proceed VFR” or a “proceed visually” instruction from the MAPt to a landing location.			x			x
LO	Recognise the differences between “proceed VFR” and “proceed visually” instruction.			x			x

062 05 04 00	FMS and general terms	
062 05 04 03	Navigation data base	
LO	State that the navigation database of the FMC may contain the following data: — Reference data for airports (four letter ICAO identifier) — VOR/DME station data (three letter ICAO identifier) — Waypoint data (five letter ICAO identifier) — STAR data — SID data — Holding patterns — Airport runway data — NDB stations (alphabetic ICAO identifier) — Company flight plan routes	x
LO	State that the navigation database is updated every 28 days.	x
LO	State that the navigational database is write protected, but additional space exists so that crew created navigational data may be saved in the computer memory. Such additional data will also be deleted at the 28 days navigational update of the database.	x
062 05 04 06	Determination of the FMS-position of the aircraft	
LO	State that modern FMS may use a range of sensors for calculating the position of the aircraft including VOR, DME, GPS, IRS and ILS.	x
062 06 00 00	**GLOBAL NAVIGATION SATELLITE SYSTEMS**	
062 06 01 00	**GPS/GLONASS/GALILEO**	
062 06 01 01	Principles	
LO	State that there are two main Global Navigation Satellite Systems (GNSS) currently in existence with a third which is planned to be fully operational by 2011. They are: — USA NAVSTAR GPS (NAVigation System with Timing And Ranging Global Positioning System — Russian GLONASS (GLObal NAvigation Satellite System) — European GALILEO	x

LO	State that all 3 systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position	x
062 06 01 02	Operation	
NAVSTAR GPS		
LO	State that there are currently two modes of operation, SPS (Standard Positioning Service) for civilian users, and PPS (Precise Positioning Service for authorised users	x
LO	SPS was originally designed to provide civil users with a less accurate positioning capability than PPS	x
LO	Name the three segments as: — Space segment — Control segment — User segment	x
Space segment		
LO	State that the space segment consists of a notional constellation of 24 operational satellites	x
LO	State that it takes 12½ minutes for a GPS receiver to receive all the data frames in the navigation message	x
LO	State that the almanac contains the orbital data about all the satellites in the GPS constellation	x
LO	State that the ephemeris contains data used to correct the orbital data of the satellites due to small disturbances	x
LO	State that the clock correction parameters are data for correction of the satellite time	x
LO	State that UTC parameters are factors determining the difference between GPS time and UTC	x
LO	State that an ionospheric model is currently used to calculate the time delay of the signal travelling through the ionosphere.	x

LO	State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data	x
LO	State that GPS uses the WGS 84 model	x
LO	State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference	x

Control Segment		
LO	State that the control segment comprises: — A master control station — Ground antenna — Monitoring stations	x
User Segment		
LO	State that GPS supplies three-dimensional position fixes and speed data, plus a precise time reference	x
LO	State that the GPS receiver used in aviation is a multi-channel type	x
LO	State that a GPS receiver is able to determine the distance to a satellite, by determining the difference between the time of transmission by satellite and the time of reception	x
LO	State that the initial distance calculated to the satellites is called pseudo range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range	x
LO	State that each range defines a sphere with its centre at the satellite	x
LO	State that three satellites are needed to determine a two-dimensional position	x
LO	State that four spheres are needed to calculate a three dimensional position, hence four satellites are required	x
LO	State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites	x
NAVSTAR GPS Integrity		
LO	Define RAIM (Receiver Autonomous Integrity Monitoring). A technique whereby a receiver processor determines the integrity of the navigation signals	x
LO	State that RAIM is achieved by consistency check among pseudo range measurements	x
LO	State that basic RAIM requires 5 satellites. A 6th is for isolating a faulty satellite from the navigation solution	x
LO	State that when a GPS receiver uses barometric altitude as an augmentation to RAIM, the number of satellites needed for the receiver to perform the RAIM function may be reduced by one	x
062 06 01 03	Errors and Factors affecting accuracy	

LO	List the most significant factors affecting accuracy: — Ionospheric propagation delay — Dilution of position — Satellite clock error — Satellite orbital variations — Multipath	x
062 06 02 00	**Ground, Satellite and Airborne based augmentation systems**	
Satellite Based Augmentation Systems (SBAS)		
LO	Explain the principle of a SBAS : to measure on the ground the signal errors transmitted by GNSS satellites and transmit differential corrections and integrity messages for navigation satellites	x
LO	State that the frequency band of the data link is identical to that of the GPS signals.	x
LO	Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas	x
LO	Explain that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites	x
LO	Stat that SBAS consists of 3 elements : — The ground infrastructure (monitoring and processing stations), — The SBAS satellites, — The SBAS airborne receivers.	x
LO	Explain that SBAS can provide approach and landing operations with Vertical guidance (APV) and precision approach service .	x
LO	Explain the difference between Coverage area and Service area	x
LO	State that Satellite Based Augmentation Systems include: — EGNOS in Western Europe and the Mediterranean — WAAS in USA — MSAS in Japan — GAGAN in India	x
EGNOS		

LO	State that (EGNOS) European Geostationary Navigation Overlay Service consists of 3 geostationary Inmarsat satellites which broadcast GPS look-alike signals	x
LO	State that EGNOS is designed to improve accuracy to 1–2 m horizontally and 3–5 m vertically	x
LO	Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hrs GPS alone)	x
Airborne Based Augmentation Systems (ABAS)		
LO	Explain the principle of ABAS: to use redundant elements within the GPS constellation (e.g. : multiplicity of distance measurements to various satellites) or the combination of GNSS measurements with those of other navigation sensors (such as inertial systems), to develop integrity control	x

LO	State that the type of ABAS using only GNSS information is RAIM (Receiver Autonomous Integrity Monitoring)	x
LO	State that a system using information from additional on-board sensors is named AAIM (Aircraft Autonomous Integrity Monitoring)	x
LO	Explain that the typical sensors used are barometric altimeter , clock and inertial navigation system	x
LO	Explain that unlike GBAS and SBAS , ABAS does not improve positioning accuracy	x

AMC8 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES
Subject IFR Communications (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR(A) and EIR
092 00 00 00	**IFR COMMUNICATIONS**	
092 01 00 00	**DEFINITIONS**	
092 01 01 00	**Meanings and significance of associated terms**	
LO	As for VFR plus terms used in conjunction with approach and holding procedures	x
092 01 02 00	**Air Traffic Control abbreviations**	
LO	As for VFR plus additional IFR related terms	x
092 01 03 00	**Q-code groups commonly used in RTF air-ground communications**	
LO	Define Q-code groups commonly used in RTF air to ground communications: — Pressure settings	x

	— Directions and bearings	
LO	State the procedure for obtaining a bearing information in flight	x
092 01 04 00	**Categories of messages**	
LO	List the categories of messages in order of priority	x
LO	Identify the types of messages appropriate to each category	x
LO	List the priority of a message (given examples of messages to compare)	x
092 02 00 00	**GENERAL OPERATING PROCEDURES**	
092 02 01 00	**Transmission of letters**	
LO	State the phonetic alphabet used in radiotelephony	x
LO	Identify the occasions when words should be spelt	x
092 02 02 00	**Transmission of numbers (including level information)**	
LO	Describe the method of transmitting numbers — Pronunciation — Single digits, whole hundreds and whole thousands	x
092 02 03 00	**Transmission of time**	
LO	Describe the ways of transmitting time — Standard time reference (UTC) — Minutes, minutes and hours, when required	x
092 02 04 00	**Transmission technique**	
LO	Explain the techniques used for making good R/T transmissions	x
092 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**	
LO	Define the meaning of standard words and phrases	x
LO	Use correct standard phraseology for each phase of IFR flight — Pushback — IFR depature — Airways clearances — Position reporting — Approach procedures — IFR arrivals	x
092 02 06 00	**Radiotelephony call signs for aeronautical stations including use of abbreviated call signs**	
LO	As for VFR	x
LO	Name the two parts of the call sign of an aeronautical station	x
LO	Identify the call sign suffixes for aeronautical stations	x
LO	Explain when the call sign may be abbreviated to the use of suffix only	x
092 02 07 00	**Radiotelephony call signs for aircraft including use of abbreviated call signs**	
LO	As for VFR	x
LO	Explain when the suffix 'HEAVY' should be used with an aircraft call sign	x
LO	Explain the use of the phrase 'Change your call sign to …'	x
LO	Explain the use of of the phrase 'Revert to flight plan call sign'	x
092 02 08 00	**Transfer of communication**	
LO	Describe the procedure for transfer of communication — By ground station — By aircraft	x
092 02 09 00	**Test procedures including readability scale; establishment of RTF communication**	
LO	Explain how to test radio transmission and reception	x
LO	State the readability scale and explain its meaning	x
092 02 10 00	**Read back and acknowledgement requirements**	

LO	State the requirement to read back ATC route clearances	x
LO	State the requirement to read back clearances related to runway in use	x
LO	State the requirement to read back other clearances including conditional clearances	x
LO	State the requirement to read back data such as runway, SSR codes etc	x
092 02 11 00	**Radar procedural phraseology**	
LO	Use the correct phraseology for an aircraft receiving a radar service — Radar identification — Radar vectoring — Traffic information and avoidance — SSR procedures	x
092 02 12 00	**Level changes and reports**	
LO	Use the correct term to describe vertical position In relation to flight level (standard pressure setting) — In relation to Altitude (metres/feet on QNH) — In relation to Height (metres/feet on QFE)	x
092 03 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**	
LO	Describe the action to be taken in communication failure on a IFR flight	x
LO	Describe the action to be taken in case of communication failure on a IFR flight when flying in VMC and the flight will be terminated in VMC	x
LO	Describe the action to be taken in case of communication failure on a IFR flight when flying in IMC	x
092 04 00 00	**DISTRESS AND URGENCY PROCEDURES**	
092 04 01 00	**PAN medical**	
LO	Describe the type of flights to which PAN MEDICAL applies	x
LO	List the content of a PAN MEDICAL message in correct sequence	x
092 04 02 00	**Distress (definition — frequencies — watch of distress frequencies — distress signal — distress message)**	
LO	State the DISTRESS procedures	x
LO	Define DISTRESS	x
LO	Identify the frequencies that should be used by aircraft in DISTRESS	x
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes	x
LO	Describe the action to be taken by the station which receives a DISTRESS message	x
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress	x
LO	List the content of a DISTRESS message	x
092 04 03 00	**Urgency (definition — frequencies — urgency signal — urgency message)**	
LO	State the URGENCY procedures	x
LO	Define URGENCY	x
LO	Identify the frequencies that should be used by aircraft in URGENCY	x
LO	Describe the action to be taken by the station which receives an URGENCY message	x
LO	List the content of an URGENCY signal/message in the correct sequence	x
092 05 00 00	**RELEVANT WEATHER INFORMATION TERMS (IFR)**	
092 05 01 00	**Aerodrome weather**	
LO	As for VFR plus the following	x
LO	Runway visual range	x

LO	Braking action (friction coefficient)	x
092 05 02 00	**Weather broadcast**	
LO	As for VFR plus the following	x
LO	Explain when aircraft routine meteorological observations should be made	x
LO	Explain when aircraft Special meteorological observations should be made	x
092 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**	
LO	Describe the radio frequency spectrum with particular reference to VHF	x
LO	State the names of the bands into which the radio frequency spectrum is divided	x
LO	Identify the frequency range of the VHF band	x
LO	Name the band normally used for Aeronautical Mobile Service voice communications	x
LO	State the frequency separation allocated between consecutive VHF frequencies	x
LO	Describe the propagation characteristics of radio transmissions in the VHF band	x
LO	Describe the factors which reduce the effective range and quality of radio transmissions	x
LO	State which of these factors apply to the VHF band	x
LO	Calculate the effective range of VHF transmissions assuming no attenuating factors	x
092 07 00 00	**MORSE CODE**	
LO	Identify radio navigation aids (VOR, DME, NDB, ILS) from their Morse code identifiers	x
LO	SELCAL, TCAS, ACARS phraseology and procedures	x

GM1 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES FOR THE EIR AND CB-IR(A)

The detailed theoretical knowledge syllabus is combined with the Learning Objectives (LOs).
The LOs refer to measurable statements of the skills and/or knowledge that a student should be able to demonstrate following a defined element of training. The LOs define the theoretical knowledge that a student should have assimilated on successful completion of an approved theoretical knowledge course and/or prior to undertaking the theoretical knowledge examinations.
The LOs are intended to be used by the training industry when developing Part-FCL theoretical knowledge courses. It should be noted, however, that the LOs do not provide a ready-made ground training syllabus for individual approved training organisations, and should not be seen by organisations as a substitute for thorough course-design.
For the preparation of theoretical knowledge courses for the issue of instrument ratings, the following information should be taken into account:
(a) Subject Air Law

(1) Subject Air Law is primarily based on ICAO documentation but will also refer to the future European operational rules and the requirements dealing with pilot licensing.
(2) National Law should not be taken into account but remains relevant during practical training and operational flying.
(3) Abbreviations used are ICAO abbreviations listed in ICAO Doc 8400, Abbreviations and Codes.

(4) Where an LO refers to a definition e.g. 'Define the following terms' or 'Define and understand' or 'Explain the definitions in …', candidates are also expected to be able to recognise a given definition.

(b) Subject Flight Planning and Flight Monitoring

(1) To fully appreciate and understand the subject Flight Planning and Flight Monitoring, the applicant will benefit from background knowledge in subjects Air Law, Aircraft General Knowledge, Mass & Balance, Performance, Meteorology, Navigation, Operational Procedures and Principles of Flight.

(2) The reference to the relevant requirements of the Regulation on Air Operations is specifically mentioned in the LOs and should be used for reference as required.

(3) The Jeppesen Student Pilots' Training Route Manual (SPTRM), otherwise known as the Training Route Manual (TRM), contains planning data plus Aerodrome and Approach charts that may be used in theoretical knowledge training courses.

FCL.620 IR — Skill test

(a) Applicants for an IR shall pass a skill test in accordance with Appendix 7 to this Part to demonstrate the ability to perform the relevant procedures and manoeuvres with a degree of competency appropriate to the privileges granted.

(b) For a multi-engine IR, the skill test shall be taken in a multi-engine aircraft. For a single-engine IR, the test shall be taken in a single-engine aircraft. A multi-engine centreline thrust aeroplane shall be considered a single-engine aeroplane for the purposes of this paragraph.

FCL.625 IR — Validity, revalidation and renewal

(a) Validity. An IR shall be valid for 1 year.

(b) Revalidation.

(1) An IR shall be revalidated within the 3 months immediately preceding the expiry date of the rating.

(2) Applicants who fail to pass the relevant section of an IR proficiency check before the expiry date of the IR shall not exercise the IR privileges until they have passed the proficiency check.

(c) Renewal. If an IR has expired, in order to renew their privileges applicants shall:

(1) go through refresher training at an ATO to reach the level of proficiency needed to pass the instrument element of the skill test in accordance with Appendix 9 to this Part; and

(2) complete a proficiency check in accordance with Appendix 9 to this Part, in the relevant aircraft category.

(d) If the IR has not been revalidated or renewed within the preceding 7 years, the holder will be required to pass again the IR theoretical knowledge examination and skill test.

AMC1 FCL.625(c) IR — Validity, revalidation and renewal

RENEWAL OF INSTRUMENT RATING: REFRESHER TRAINING

(a) Paragraph (b)(1) of FCL.740 determines that if the instrument rating has lapsed, the applicant shall go through refresher training at an ATO, to reach the level of proficiency needed to pass the instrument element of the skill test prescribed in Appendix 9 to Part-FCL. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant. To determine this, the ATO should evaluate the pilot's log book, and, if necessary, conduct a test in an FSTD.

(2) the amount of time lapsed since the expiry of the validity period of the rating. The amount of training needed to reach the desired level of proficiency should increase with the time lapsed. In some cases, after evaluating the pilot, and when the time lapsed is very limited (less than 3 months), the ATO may even determine that no further refresher training is necessary. The following may be taken as guidance when determining the needs of the applicant:

(i) expiry for a period shorter than 3 months: no supplementary requirements;

(ii) expiry for longer than 3 months but shorter than 1 year: a minimum of one training session;

(iii) expiry for longer than 1 year but shorter than 7 years: a minimum of three training sessions;

(iv) expiry for longer than 7 years: the applicant should undergo the full training course for the issue of the IR.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme, which should be based on the initial training for the issue of instrument ratings and focus on the aspects where the applicant has shown the greatest needs.

(c) After successful completion of the training, the ATO should give a certificate to the applicant, to be submitted to the competent authority when applying for the renewal.

SECTION 2 - Specific requirements for the aeroplane category

FCL.625.A IR(A) — Revalidation

(a) Revalidation. Applicants for the revalidation of an IR(A):

(1) when combined with the revalidation of a class or type rating, shall pass a proficiency check in accordance with Appendix 9 to this Part;

(2) when not combined with the revalidation of a class or type rating, shall:

(i) for single-pilot aeroplanes, complete section 3b and those parts of section 1 relevant to the intended flight, of the proficiency check prescribed in Appendix 9 to this Part; and

(ii) for multi-engine aeroplanes, complete section 6 of the proficiency check for single-pilot aeroplanes in accordance with Appendix 9 to this Part by sole reference to instruments.

(3) An FNPT II or an FFS representing the relevant class or type of aeroplane may be used in the case of paragraph (2), but at least each alternate proficiency check for the revalidation of an IR(A) in these circumstances shall be performed in an aeroplane.

(b) Cross-credit shall be given in accordance with Appendix 8 to this Part.

SECTION 3 - Specific requirements for the helicopter category

FCL.625.H IR(H) — Revalidation

(a) Applicants for the revalidation of an IR(H):

(1) when combined with the revalidation of a type rating, shall complete a proficiency check in accordance with Appendix 9 to this Part, for the relevant type of helicopter;

(2) when not combined with the revalidation of a type rating, shall complete only section 5 and the relevant parts of section 1 of the proficiency check established in Appendix 9 to this Part for the relevant type of helicopter. In this case, an FTD 2/3 or an FFS representing the relevant type of helicopter may be used, but at least each alternate proficiency check for the revalidation of an IR(H) in these circumstances shall be performed in a helicopter.

(b) Cross-credit shall be given in accordance with Appendix 8 to this Part.

FCL.630.H IR(H) — Extension of privileges from single-engine to multi- engine helicopters

Holders of an IR(H) valid for single-engine helicopters wishing to extend for the first time the IR(H) to multi-engine helicopters shall complete:

(a) a training course at an ATO comprising at least 5 hours dual instrument instruction time, of which 3 hours may be in an FFS or FTD 2/3 or FNPT II/III; and

(b) section 5 of the skill test in accordance with Appendix 9 to this Part on multi-engine helicopters.

SECTION 4 - Specific requirements for the airship category

FCL.625.As IR(As) — Revalidation

Applicants for the revalidation of an IR(As):

(a) when combined with the revalidation of a type rating, shall complete a proficiency check in accordance with Appendix 9 to this Part, for the relevant type of airship;

(b) when not combined with the revalidation of a type rating, shall complete section 5 and those parts of section 1 relevant to the intended flight of the proficiency check for airships in accordance with Appendix 9 of this part. In this case, an FTD 2/3 or FFS representing the relevant type may be used, but at least each alternate proficiency check for the revalidation of an IR(As) in these circumstances shall be performed in an airship.

SUBPART H - CLASS AND TYPE RATINGS

SECTION 1 - Common requirements

FCL.700 Circumstances in which class or type ratings are required

(a) Holders of a pilot licence shall not act in any capacity as pilots of an aircraft unless they have a valid and appropriate class or type rating, except in any of the following cases:

(i) for LAPL, SPL and BPL;

(ii) when undergoing skill tests, or proficiency checks for renewal of class or type ratings;

(iii) when receiving flight instruction;

(iv) when they hold a flight test rating issued in accordance with FCL.820.

(b) Notwithstanding (a), in the case of flights related to the introduction or modification of aircraft types, pilots may hold a special certificate given by the competent authority, authorising them to perform the flights. This authorisation shall have its validity limited to the specific flights.

(c) Deleted

GM1 FCL.700 Circumstances in which class or type ratings are required

LIST OF CLASS OR TYPE RATINGS

The following tables contain lists of aeroplanes or TMG that are included in class ratings.

(a) Class ratings (aeroplane): SP and SEP or MEP aeroplane (land or sea):

Manufacturer	Aeroplanes		Licence Endorsement
All manufacturers	SEP (land)	**(D)**	**SEP (land)**
	SEP (land) with variable pitch propellers		
	SEP (land) with retractable undercarriage		
	SEP (land) with turbo or super charged engines		
	SEP (land) with cabin pressurisation		
	SEP (land) with tail wheels		
	SEP (land) with EFIS		
	SEP (land) with SLPC		
	SEP (sea)	**(D)**	**SEP (sea)**
	SEP (sea) with variable pitch propellers		
	SEP (sea) with turbo or super charged engines		

	SEP (sea) with cabin pressurisation		
	SEP (sea) with EFIS		
	SEP (sea) with SLPC		
All manufacturers	MEP (land)	**(D)**	**MEP (land)**
	MEP (sea)	**(D)**	**MEP (sea)**

(b) Class ratings (aeroplane): SP and SEP TMG (land):

Manufacturer	**Aeroplanes**		**Licence Endorsement**
All manufacturers	All TMGs having an integrally mounted, non-retractable engine and a non-retractable propeller		**TMG**

(c) Additional class and type rating lists and endorsement lists are published by the Agency.

(d) Whenever (D) is indicated in one of the lists mentioned in paragraphs (a) to (c), it indicates that differences training in accordance with FCL.710 is required.

FCL.705 Privileges of the holder of a class or type rating

The privileges of the holder of a class or type rating are to act as pilot on the class or type of aircraft specified in the rating.

FCL.710 Class and type ratings — variants

(a) In order to extend his/her privileges to another variant of aircraft within one class or type rating, the pilot shall undertake differences or familiarisation training. In the case of variants within a type rating, the differences or familiarisation training shall include the relevant elements defined in the operational suitability data established in accordance with Part-21.

(b) If the variant has not been flown within a period of 2 years following the differences training, further differences training or a proficiency check in that variant shall be required to maintain the privileges, except for types or variants within the single-engine piston and TMG class ratings.

(c) The differences training shall be entered in the pilot's logbook or equivalent record and signed by the instructor as appropriate.

GM1 FCL.710 Class and type ratings — variants. Differences and familiarisation training

(a) Differences training requires the acquisition of additional knowledge and training on an appropriate training device or the aircraft.

(b) Familiarisation training requires the acquisition of additional knowledge.

FCL.725 Requirements for the issue of class and type ratings

(a) Training course. An applicant for a class or type rating shall complete a training course at an ATO. The type rating training course shall include the mandatory training elements for the relevant type as defined in the operational suitability data established in accordance with Part-21.

(b) Theoretical knowledge examination. The applicant for a class or type rating shall pass a theoretical knowledge examination organised by the ATO to demonstrate the level of theoretical knowledge required for the safe operation of the applicable aircraft class or type.

(1) For multi-pilot aircraft, the theoretical knowledge examination shall be written and comprise at least 100 multiple-choice questions distributed appropriately across the main subjects of the syllabus.

(2) For single-pilot multi-engine aircraft, the theoretical knowledge examination shall be written and the number of multiple-choice questions shall depend on the complexity of the aircraft.

(3) For single-engine aircraft, the theoretical knowledge examination shall be conducted verbally by the examiner during the skill test to determine whether or not a satisfactory level of knowledge has been achieved.

(4) For single-pilot aeroplanes that are classified as high performance aeroplanes, the examination shall be written and comprise at least 100 multiple-choice questions distributed appropriately across the subjects of the syllabus.

(c) Skill test. An applicant for a class or type rating shall pass a skill test in accordance with Appendix 9 to this Part to demonstrate the skill required for the safe operation of the applicable class or type of aircraft.

The applicant shall pass the skill test within a period of 6 months after commencement of the class or type rating training course and within a period of 6 months preceding the application for the issue of the class or type rating.

(d) An applicant who already holds a type rating for an aircraft type, with the privilege for either single-pilot or multi-pilot operations, shall be considered to have already fulfilled the theoretical requirements when applying to add the privilege for the other form of operation on the same aircraft type.

(e) Notwithstanding the paragraphs above, pilots holding a flight test rating issued in accordance with FCL.820 who were involved in development, certification or production flight tests for an aircraft type, and have completed either 50 hours of total flight time or 10 hours of flight time as PIC on test flights in that type, shall be entitled to apply for the issue of the relevant type rating, provided that they comply with the experience requirements and the prerequisites for the issue of that type rating, as established in this Subpart for the relevant aircraft category.

AMC1 FCL.725(a) Requirements for the issue of class and type ratings

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CLASS OR TYPE RATINGS

I. SE AND ME AEROPLANES

(a) Detailed listing for aeroplane structure and equipment, normal operation of systems and malfunctions:

(1) dimensions: minimum required runway width for 180 ° turn.

(2) engine including auxiliary power unit:

(i) type of engine or engines;

(ii) in general, function of the following systems or components:

(A) engine;

(B) auxiliary power unit;

(C) oil system;

(D) fuel system;

(E) ignition system;

(F) starting system;

(G) fire warning and extinguishing system;

(H) generators and generator drives;

(I) power indication;

(J) reverse thrust;

(K) water injection.

(iii) on piston or turbine-propeller engines additionally:

(A) propeller system;

(B) feathering system.

(iv) engine controls (including starter), engine instruments and indications in the cockpit, their function, interrelation and interpretation;

(v) engine operation, including APU, during engine start, start and engine malfunctions, procedures for normal operation in the correct sequence.

(3) fuel system:

(i) location of the fuel tanks, fuel pumps, fuel lines to the engines, tank capacities, valves and measuring;

(ii) location of the following systems:

(A) filtering;

(B) heating;

(C) fuelling and defueling;

(D) dumping;

(E) venting.

(iii) in the cockpit:

(A) the monitors and indicators of the fuel system;

(B) quantity and flow indication, interpretation.

(iv) procedures:

(A) fuel procedures distribution into the various tanks;

(B) fuel supply, temperature control and fuel dumping.

(4) pressurisation and air conditioning:

(i) components of the system and protection devices;

(ii) cockpit monitors and indicators;

(iii) interpretation about the operational condition;

(iv) normal operation of the system during start, cruise, approach and landing, air conditioning airflow and temperature control.

(5) ice and rain protection, windshield wipers and rain repellent:

(i) ice protected components of the aeroplane including engines, heat sources, controls and indications;

(ii) operation of the anti-icing or de-icing system during take-off, climb, cruise and descent, conditions requiring the use of the protection systems;

(iii) controls and indications of the windshield wipers and rain repellent systems operation.

(6) hydraulic system:

(i) components of the hydraulic system(s), quantities and system pressure, hydraulically actuated components associated to the respective hydraulic system;

(ii) controls, monitors and indicators in the cockpit, function and interrelation and interpretation of indications.

(7) landing gear:

(i) main components of the:

(A) main landing gear;

(B) nose gear;

(C) gear steering;

(D) wheel brake system, including anti-skid.

(ii) gear retraction and extension (including changes in trim and drag caused by gear operation);

(iii) required tyre pressure, or location of the relevant placard;

(iv) controls and indicators including warning indicators in the cockpit in relation to the retraction or extension condition of the landing gear and brakes;

(v) components of the emergency extension system.

(8) flight controls and high lift devices:

(i) (A) aileron system;

(B) elevator system;

(C) rudder system;

(D) trim system;

(E) spoiler system;

(F) lift devices;

(G) stall warning system;

(H) take-off configuration warning system.

(ii) flight control system from the cockpit controls to the flight control or surfaces;

(iii) controls, monitors and indicators including warning indicators of the systems mentioned under (8) (i), interrelation and dependencies.

(9) electrical power supply:

(i) number, power, voltage, frequency and location of the main power system (AC or DC), auxiliary power system location and external power system;

(ii) location of the controls, monitors and indicators in the cockpit;

(iii) flight instruments, communication and navigation systems, main and back-up power sources;

(iv) location of vital circuit breakers;

(v) generator operation and monitoring procedures of the electrical power supply.

(10) flight instruments, communication, radar and navigation equipment, autoflight and flight data recorders:

(i) visible antennae;

(ii) controls and instruments of the following equipment in the cockpit during normal operation:

(A) flight instruments;

(B) flight management systems;

(C) radar equipment, including radio altimeter;

(D) communication and navigation systems;

(E) autopilot;

(F) flight data recorder, cockpit voice recorder and data-link communication recording function;

(G) TAWS;

(H) collision avoidance system;

(I) warning systems.

(11) cockpit, cabin and cargo compartment:

(i) operation of the exterior, cockpit, cabin and cargo compartment lighting and the emergency lighting;

(ii) operation of the cabin and cargo doors, stairs, windows and emergency exits;

(iii) main components of the oxygen system and their location, oxygen masks and operation of the oxygen systems for the crew and passengers, required amount of oxygen by means of a table or diagram.

(12) emergency equipment operation and correct application of the following emergency equipment in the aeroplane:

(i) portable fire extinguisher;

(ii) first-aid kits;

(iii) portable oxygen equipment;

(iv) emergency ropes;

(v) life-jacket;

(vi) life rafts;

(vii) emergency transmitters;

(viii) crash axes;

(ix) megaphones;

(x) emergency signals.

(13) pneumatic system:

(i) components of the pneumatic system, pressure source and actuated components;

(ii) controls, monitors and indicators in the cockpit and function of the system;

(iii) vacuum system.

(b) Limitations:

(1) general limitations:

(i) certification of the aeroplane, category of operation, noise certification and maximum and minimum performance data for all flight profiles, conditions and aircraft systems:

(A) maximum tail and crosswind-components at take-off and landing;

(B) maximum speeds for flap extension v_{fo};

(C) at various flap settings v_{fe};

(D) for landing gear operation v_{lo}, M_{lo};

(E) for extended landing gear v_{le}, M_{le};

(F) for maximum rudder deflection v_a, M_a;

(G) for tyres;

(H) one propeller feathered.

(ii) (A) minimum control speed air v_{mca};

(B) minimum control speed ground v_{mcg};

(C) stall speed under various conditions v_{so}, v_{s1};

(D) maximum speed v_{ne}, M_{ne};

(E) maximum speed for normal operation v_{mo}, M_{mo};

(F) altitude and temperature limitations;

(G) stick shaker activation.

(iii) (A) maximum airport pressure altitude, runway slope;

(B) maximum taxi mass;

(C) maximum take-off mass;

(D) maximum lift off mass;

(E) maximum landing mass;

(F) zero fuel mass;

(G) maximum dumping speed V_{dco}, M_{dco}, V_{dce}, M_{dce};

(H) maximum load factor during operation;

(I) certificated range of centre of gravity.

(2) engine limitations:

(i) operating data of the engines:

(A) time limits and maximum temperatures;

(B) minimum RPMs and temperatures;

(C) torque;

(D) maximum power for take-off and go-around on pressure altitude or flight altitude and temperature;

(E) piston engines: certified range of mixture;

(F) minimum and maximum oil temperature and pressure;

(G) maximum starter time and required cooling;

(H) time between two start attempts for engines and auxiliary power unit;

(I) for propeller: maximum RPM of propeller triggering of automatic feathering device.

(ii) certified oil grades.

(3) systems limitations:

(i) operating data of the following systems:

(A) pressurisation, air conditioning maximum pressures;

(B) electrical power supply, maximum load of main power system (AC or DC);

(C) maximum time of power supply by battery in case of emergency;

(D) mach trim system and yaw damper speed limits;

(E) autopilot limitations of various modes;

(F) ice protection;

(G) speed and temperature limits of window heat;

(H) temperature limits of engine and wing anti-ice.

(ii) fuel system: certified fuel specifications, minimum and maximum pressures and temperature of the fuel.

(4) minimum equipment list.

(c) Performance, flight planning and monitoring:

(1) performance calculation about speeds, gradients, masses in all conditions for take-off, en-route, approach and landing according to the documentation available (for example

for take-off v_1, v_{mbe}, v_r, v_{lof}, v_2, take-off distance, maximum take-off mass and the required stop distance) on the following factors:

(i) accelerate or stop distance;

(ii) take-off run and distance available (TORA, TODA);

(iii) ground temperature, pressure altitude, slope, wind;

(iv) maximum load and maximum mass (for example ZFM);

(v) minimum climb gradient after engine failure;

(vi) influence of snow, slush, moisture and standing water on the runway;

(vii) possible single or dual engine failure during cruise flight;

(viii) use of anti-icing systems;

(ix) failure of water injection system or antiskid system;

(x) speeds at reduced thrust, v_1, v_{1red}, v_{mbe}, v_{mu}, v_r, v_{lof}, v_2;

(xi) safe approach speed v_{ref}, on v_{mca} and turbulent conditions;

(xii) effects of excessive approach speed and abnormal glideslope on the landing distance;

(xiii) minimum climb gradient during approach and landing;

(xiv) limiting values for a go-around with minimum fuel;

(xv) maximum allowable landing mass and the landing distance for the destination and alternate aerodrome on the following factors:

(A) available landing distance;

(B) ground temperature, pressure altitude, runway slope and wind;

(C) fuel consumption to destination or alternate aerodrome;

(D) influence of moisture on the runway, snow, slush and standing water;

(E) failure of the water injection system or the anti skid system;

(F) influence of thrust reverser and spoilers.

(2) flight planning for normal and abnormal conditions:

(i) optimum or maximum flight level;

(ii) minimum required flight altitude;

(iii) drift down procedure after an engine failure during cruise flight;

(iv) power setting of the engines during climb, cruise and holding under various circumstances, as well as the most economic cruising flight level;

(v) calculation of a short range or long range flight plan;

(vi) optimum and maximum flight level and power setting of the engines after engine failure.

(3) flight monitoring.

(d) Load and balance and servicing:

(1) load and balance:

(i) load and trim sheet on the maximum masses for take-off and landing;

(ii) centre of gravity limits;

(iii) influence of fuel consumption on the centre of gravity;

(iv) lashing points, load clamping, maximum ground load.

(2) servicing on ground, servicing connections for:

(i) fuel;

(ii) oil;

(iii) water;

(iv) hydraulic;

(v) oxygen;

(vi) nitrogen;

(vii) conditioned air;

(viii) electric power;

(ix) start air;

(x) toilet and safety regulations.

(e) Emergency procedures:

(1) recognition of the situation as well as immediate memory actions in correct sequence and for those conditions recognised as emergencies by the manufacturer and competent authority for certification:

(i) engine failure during take-off before and after v_1, as well as in-flight;

(ii) malfunctions of the propeller system;

(iii) engine overheat, engine fire on ground and in-flight;

(iv) wheel well fire;

(v) electrical smoke or fire;

(vi) rapid decompression and emergency descent;

(vii) air-conditioning overheat, anti-ice system overheat;

(viii) fuel pump failure;

(ix) fuel freezing overheat;

(x) electric power failure;

(xi) equipment cooling failure;

(xii) flight instrument failure;

(xiii) partial or total hydraulic failure;

(xiv) failures at the lift devices and flight controls including boosters;

(xv) cargo compartment smoke or fire.

(2) actions according to the approved abnormal and emergency checklist:

(i) engine restart in-flight;

(ii) landing gear emergency extension;

(iii) application of the emergency brake system;

(iv) emergency extension of lift devices;

(v) fuel dumping;

(vi) emergency descent.

(f) Special requirements for extension of a type rating for instrument approaches down to decision heights of less than 200 ft (60 m):

(1) airborne and ground equipment:

(i) technical requirements;

(ii) operational requirements;

(iii) operational reliability;

(iv) fail operational;

(v) fail passive;

(vi) equipment reliability;

(vii) operating procedures;

(viii) preparatory measures;

(ix) operational downgrading;

(x) communications.

(2) procedures and limitations:

(i) operational procedures;

(ii) crew coordination.

(g) Special requirements for 'glass cockpit' aeroplanes with EFIS
Additional learning objectives:

(1) general rules of aeroplanes computer hardware and software design;

(2) logic of all crew information and alerting systems and their limitations;

(3) interaction of the different aeroplane computer systems, their limitations, the possibilities of computer fault recognition and the actions to be performed on computer failures;

(4) normal procedures including all crew coordination duties;

(5) aeroplane operation with different computer degradations (basic flying).

(h) Flight management systems.

II. SE AND ME HELICOPTERS

(a) Detailed listing for helicopters structure, transmissions, rotors and equipment, normal and abnormal operation of systems:

(1) dimensions.

(2) engine including aux. power unit, rotor and transmissions; if an initial type rating for a turbine engine helicopter is applied for, the applicant should have received turbine engine instruction:

(i) type of engine or engines;

(ii) in general, the function of the following systems or components:

(A) engine;

(B) auxiliary power unit;

(C) oil system;

(D) fuel system;

(E) ignition system;

(F) starting system;

(G) fire warning and extinguishing system;

(H) generators and generator drive;

(I) power indication;

(J) water or methanol injection.

(iii) engine controls (including starter), engine instruments and indications in the cockpit, their function and interrelation and interpretation;

(iv) engine operation, including APU, during engine start and engine malfunctions, procedures for normal operation in the correct sequence;

(v) transmission system:

(A) lubrication;

(B) generators and generator drives;

(C) freewheeling units;

(D) hydraulic drives;

(E) indication and warning systems.

(vi) type of rotor systems: indication and warning systems.

(3) fuel system:

(i) location of the fuel tanks, fuel pumps, fuel lines to the engines tank capacities, valves and measuring;

(ii) the following systems:

(A) filtering;

(B) fuelling and defuelling heatings;

(C) dumping;

(D) transferring;

(E) venting.

(iii) in the cockpit: the monitors and indicators of the fuel system, quantity and flow indication, interpretation;

(iv) fuel procedures distribution into the various tanks

fuel supply and fuel dumping.

(4) air conditioning:

(i) components of the system and protection devices;

(ii) cockpit monitors and indicators;

Note: interpretation about the operational condition: normal operation of the system during start, cruise approach and landing, air conditioning airflow and temperature control.

(5) ice and rain protection, windshield wipers and rain repellent:

(i) ice protected components of the helicopter, including engines and rotor systems, heat sources, controls and indications;

(ii) operation of the anti-icing or de-icing system during take-off, climb, cruise and descent, conditions requiring the use of the protection systems;

(iii) controls and indications of the windshield wipers and rain repellent system operation.

(6) hydraulic system:

(i) components of the hydraulic system(s), quantities and system pressure, hydraulically actuated components associated to the respective hydraulic system;

(ii) controls, monitors and indicators in the cockpit, function and interrelation and interpretation of indications.

(7) landing gear, skids fixed and floats:

(i) main components of the:

(A) main landing gear;

(B) nose gear;

(C) tail gear;

(D) gear steering;

(E) wheel brake system.

(ii) gear retraction and extension;

(iii) required tyre pressure, or location of the relevant placard;

(iv) controls and indicators including warning indicators in the cockpit in relation to the retraction or extension condition of the landing gear;

(v) components of the emergency extension system.

(8) flight controls, stab- and autopilot systems: controls, monitors and indicators including warning indicators of the systems, interrelation and dependencies.

(9) electrical power supply:

(i) number, power, voltage, frequency and if applicable phase and location of the main power system (AC or DC) auxiliary power system location and external power system;

(ii) location of the controls, monitors and indicators in the cockpit;

(iii) main and back-up power sources flight instruments, communication and navigation systems, main and back-up power sources;

(iv) location of vital circuit breakers;

(v) generator operation and monitoring procedures of the electrical power supply.

(10) flight instruments, communication, radar and navigation equipment, autoflight and flight data recorders:

(i) antennas;

(ii) controls and instruments of the following equipment in the cockpit:

(A) flight instruments (for example air speed indicator, pitot static system, compass system, flight director);

(B) flight management systems;

(C) radar equipment (for example weather radar, transponder);

(D) communication and navigation system (for example HF, VHF, ADF, VOR/DME, ILS, marker beacon) and area navigation systems;

(E) stabilisation and autopilot system;

(F) flight data recorder, cockpit voice recorder, data-link communication recording function and radio altimeter;

(G) collision avoidance system;

(H) TAWS;

(I) HUMS.

(11) cockpit, cabin and cargo compartment:

(i) operation of the exterior, cockpit, cabin and cargo compartment lighting and the emergency lighting;

(ii) operation of the cabin doors and emergency exits.

(12) emergency equipment:

(i) operation and correct application of the following mobile emergency equipment in the helicopter:

(A) portable fire extinguisher;

(B) first-aid kits;

(C) portable oxygen equipment;

(D) emergency ropes;

(E) life-jacket;

(F) life rafts;

(G) emergency transmitters;

(H) crash axes;

(I) megaphones;

(J) emergency signals;

(K) torches.

(ii) operation and correct application of the fixed emergency equipment in the helicopter: emergency floats.

(b) Limitations:

(1) general limitations, according to the helicopter flight manual;

(2) minimum equipment list.

(c) Performance, flight planning and monitoring:

(1) performance calculation about speeds, gradients, masses in all conditions for take-off, en-route, approach and landing:

(i) take-off:

(A) hover performance in and out of ground effect;

(B) all approved profiles, cat A and B;

(C) HV diagram;

(D) take-off and rejected take-off distance;

(E) take-off decision point (TDP) or (DPATO);

(F) calculation of first and second segment distances;

(G) climb performance.

(ii) en-route:

(A) air speed indicator correction;

(B) service ceiling;

(C) optimum or economic cruising altitude;

(D) max endurance;

(E) max range;

(F) cruise climb performance.

(iii) landing:

(A) hovering in and out of ground effect;

(B) landing distance;

(C) landing decision point (LDP) or (DPBL).

(iv) knowledge or calculation of: v_{lo}, v_{le}, v_{mo}, v_{x}, v_{y}, v_{toss}, v_{ne}, $v_{max\ range}$, v_{mini}.

(2) flight planning for normal and abnormal conditions:

(i) optimum or maximum flight level;

(ii) minimum required flight altitude;

(iii) drift down procedure after an engine failure during cruise flight;

(iv) power setting of the engines during climb, cruise and holding under various circumstances as well as at the most economic cruising flight level;

(v) optimum and maximum flight level and power setting after an engine failure.

(3) effect of optional equipment on performance.

(d) Load, balance and servicing:

(1) load and balance:

(i) load and trim sheet on the maximum masses for take-off and landing;

(ii) centre of gravity limits;

(iii) influence of the fuel consumption on the centre of gravity;

(iv) lashing points, load clamping, max ground load.

(2) servicing on the ground, servicing connections for:

(i) fuel;

(ii) oil, etc.;

(iii) and safety regulations for servicing.

(e) Emergency procedures.

(f) Special requirements for extension of a type rating for instrument approaches down to a decision height of less than 200 ft (60 m):

(1) airborne and ground equipment:

(i) technical requirements;

(ii) operational requirements;

(iii) operational reliability;

(iv) fail operational;

(v) fail passive;

(vi) equipment reliability;

(vii) operating procedures;

(viii) preparatory measures;

(ix) operational downgrading;

(x) communication.

(2) procedures and limitations:

(i) operational procedures;

(ii) crew co-ordination.

(g) Special requirements for helicopters with EFIS.

(h) Optional equipment.

III. AIRSHIPS

(a) Detailed listing for airship structure and equipment, normal operation of systems and malfunctions:

(1) dimensions;

(2) structure and envelope:

(i) internal structure;

(ii) envelope;

(iii) pressure system;

(iv) gondola;

(v) empennage.

(3) flight controls;

(4) systems:

(i) hydraulic;

(ii) pneumatic.

(5) landing gear;

(6) fuel system;

(7) fire warning and extinguishing system;

(8) emergency equipment;

(9) electrical systems;

(10) avionics, radio navigation and communication equipment;

(11) instrumentation;

(12) engines and propellers;

(13) heating, ventilation and air-condition;

(14) operational procedures during start, cruise, approach and landing:

(i) normal operations;

(ii) abnormal operations.

(b) Limitations:

(1) general limitations:

(i) certification of the airship, category of operation, noise certification and maximum and minimum performance data for all flight profiles, conditions and aircraft systems;

(ii) speeds;

(iii) altitudes.

(2) engine limitations;

(3) systems limitations;

(4) minimum equipment list.

(c) Performance and flight planning:

(1) performance calculation;

(2) flight planning.

(d) Load and balance and servicing:

(1) load and balance;

(2) servicing.

(e) Emergency procedures:

(1) recognition of emergency situations;

(2) actions according to the approved abnormal and emergency checklist.

AMC2 FCL.725(a) Requirements for the issue of class and type ratings

TRAINING COURSE

FLIGHT INSTRUCTION FOR TYPE RATINGS: HELICOPTERS

(a) The amount of flight instruction depends on:

(i) complexity of the helicopter type, handling characteristics, level of technology;

(ii) category of helicopter (SEP or SE turbine helicopter, ME turbine and MP helicopter);

(iii) previous experience of the applicant;

(iv) the availibiliy of FSTDs.

(b) FSTDs

The level of qualification and the complexity of the type will determine the amount of practical training that may be accomplished in FSTDs, including completion of the skill test. Before undertaking the skill test, a student should demonstrate competency in the skill test items during the practical training.

(c) Initial issue

The flight instruction (excluding skill test) should comprise:

Helicopter types	In helicopter	In helicopter and FSTD associated training Credits
SEP (H)	5 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 6 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 6 hrs total
SET(H) under 3175 kg MTOM	5 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 6 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 6 hrs total
SET(H) at or over 3175 kg MTOM	8 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 10 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 10 hrs total
SPH MET (H) CS and FAR 27 and 29	8 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 10 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 10 hrs total
MPH	10 hrs	Using FFS C/D: At least 2 hrs helicopter, and at least 12 hrs total

		Using FTD 2/3: At least 4 hrs helicopter, and at least 12 hrs total

(d) Additional types

The flight instruction (excluding skill test) should comprise:

Helicopter types	In helicopter	In helicopter and FSTD associated training Credits
SEP(H) to SEP(H) within AMC1 FCL.740.H (a)(3)	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total Using FTD 2/3: At least 1 hr helicopter and at least 4 hrs total
SEP(H) to SEP(H) not included in AMC1 FCL.740.H (a)(3)	5 hrs	Using FFS C/D: At least 1 hr helicopter and at least 6 hrs total Using FTD 2/3: At least 2 hr helicopter and at least 7 hrs total
SET(H) to SET(H)	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total Using FTD 2/3: At least 1 hr helicopter and at least 4 hrs total
SE difference training	1 hr	N/A
MET(H) to MET(H)	3 hrs	Using FFS C/D: At least 1 hr helicopter and at least 4 hrs total Using FTD 2/3: At least 2 hrs helicopter and at least 5 hrs total
ME difference training	1 hrs	N/A
MPH to MPH	5 hrs	Using FFS C/D: At least 1 hr helicopter and at least 6 hrs total Using FTD 2/3: At least 2 hrs helicopter and at least 7 hrs total
Extend privileges on the same type rating from SPH to MPH (except for initial MP issue), or from MPH to SPH	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total

(e) Holders of an IR(H) wishing to extend the IR(H) to further types should have additionally 2 hours flight training on type by sole reference to instruments according to IFR which may be conducted in an FFS C/D or FTD 2/3. Holders of an SE IR(H) wishing to extend the IR privileges to an ME IR(H) for the first time should complete at least 5 hours training.

FCL.740 Validity and renewal of class and type ratings

(a) The period of validity of class and type ratings shall be 1 year, except for single-pilot single-engine class ratings, for which the period of validity shall be 2 years, unless otherwise determined by the operational suitability data, established in accordance with Part-21.

(b) Renewal. If a class or type rating has expired, the applicant shall:

(1) take refresher training at an ATO, when necessary to reach the level of proficiency necessary to safely operate the relevant class or type of aircraft; and

(2) pass a proficiency check in accordance with Appendix 9 to this Part.

AMC1 FCL.740(b)(1) Validity and renewal of class and type ratings

RENEWAL OF CLASS AND TYPE RATINGS: REFRESHER TRAINING

(a) Paragraph (b)(1) of FCL.740 determines that if a class or type rating has lapsed, the applicant shall take refresher training at an ATO. The objective of the training is to reach the level of proficiency necessary to safely operate the relevant type or class of aircraft. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant. To determine this, the ATO should evaluate the pilot's log book, and, if necessary, conduct a test in an FSTD;

(2) the complexity of the aircraft;

(3) the amount of time lapsed since the expiry of the validity period of the rating. The amount of training needed to reach the desired level of proficiency should increase with the time lapsed. In some cases, after evaluating the pilot, and when the time lapsed is very limited (less than 3 months), the ATO may even determine that no further refresher training is necessary. When determining the needs of the pilot, the following items can be taken into consideration:

(i) expiry shorter than 3 months: no supplementary requirements;

(ii) expiry longer than 3 months but shorter than 1 year: a minimum of two training sessions;

(iii) expiry longer than 1 year but shorter than 3 years: a minimum of three training sessions in which the most important malfunctions in the available systems are covered;

(iv) expiry longer than 3 years: the applicant should again undergo the training required for the initial issue of the rating or, in case of helicopter, the training required for the 'additional type issue', according to other valid ratings held.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme that should be based on the initial training for the issue of the rating and focus on the aspects where the applicant has shown the greatest needs.

(c) After successful completion of the training, the ATO should give a certificate, or other documental evidence that the training has been successfully achieved to the applicant, to be submitted to the competent authority when applying for the renewal. The certificate or documental evidence needs to contain a description of the training programme.

SECTION 2 - Specific requirements for the aeroplane category

FCL.720.A Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes

Unless otherwise determined in the operational suitability data established in accordance with Part-21, an applicant for a class or type rating shall comply with the following experience requirements and prerequisites for the issue of the relevant rating:

(a) Single-pilot multi-engine aeroplanes. An applicant for a first class or type rating on a single-pilot multi-engine aeroplane shall have completed at least 70 hours as PIC on aeroplanes.

(b) Single-pilot high performance non-complex aeroplanes. Before starting flight training, an applicant for a first class or type rating for a single-pilot aeroplane classified as a high performance aeroplane shall:

(1) have at least 200 hours of total flying experience, of which 70 hours as PIC on aeroplanes; and

(2)

(i) hold a certificate of satisfactory completion of a course for additional theoretical knowledge undertaken at an ATO; or

(ii) have passed the ATPL(A) theoretical knowledge examinations in accordance with this Part; or

(iii) hold, in addition to a licence issued in accordance with this Part, an ATPL(A) or CPL(A)/IR with theoretical knowledge credit for ATPL(A), issued in accordance with Annex 1 to the Chicago Convention;

(3) in addition, pilots seeking the privilege to operate the aeroplane in multi- pilot operations shall meet the requirements of (d)(4).

(c) Single-pilot high performance complex aeroplanes. Applicants for the issue of a first type rating for a complex single-pilot aeroplane classified as a high performance aeroplane shall, in addition to meeting the requirements of (b), have fulfilled the requirements for a multi-engine IR(A), as established in Subpart G.

(d) Multi-pilot aeroplanes. An applicant for the first type rating course for a multi-pilot aeroplane shall be a student pilot currently undergoing training on an MPL training course or comply with the following requirements:

(1) have at least 70 hours of flight experience as PIC on aeroplanes;

(2) hold a multi-engine IR(A);

(3) have passed the ATPL(A) theoretical knowledge examinations in accordance with this Part; and

(4) except when the type rating course is combined with an MCC course:

(i) hold a certificate of satisfactory completion of an MCC course in aeroplanes; or

(ii) hold a certificate of satisfactory completion of MCC in helicopters and have more than 100 hours of flight experience as a pilot on multi-pilot helicopters; or

(iii) have at least 500 hours as a pilot on multi-pilot helicopters; or

(iv) have at least 500 hours as a pilot in multi-pilot operations on single- pilot multi-engine aeroplanes, in commercial air transport in accordance with the applicable air operations requirements.

(e) Notwithstanding point (d), a Member State may issue a type rating with restricted privileges for multi-pilot aeroplanes that allows the holder of such rating to act as a cruise relief co-pilot above Flight Level 200, provided that two other members of the crew have a type rating in accordance with point (d).

(f) Additional multi-pilot and single-pilot high performance complex aeroplane type ratings. An applicant for the issue of additional multi-pilot type ratings and single-pilot high performance complex aeroplanes type ratings shall hold a multi-engine IR(A).

(g) When so determined in the operational suitability data established in accordance with Part-21, the exercise of the privileges of a type rating may be initially limited to flight under the supervision of an instructor. The flight hours under supervision shall be entered in the pilot's logbook or equivalent record and signed by the instructor. The limitation shall be removed when the pilot demonstrates that the hours of flight under supervision required by the operational suitability data have been completed.

AMC1 FCL.720.A(b)(2)(i) Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes

ADDITIONAL THEORETICAL KNOWLEDGE FOR A CLASS OR TYPE RATING FOR HIGH PERFORMANCE SP AEROPLANES

(a) A number of aeroplanes certificated for SP operation have similar performances, systems and navigation capabilities to those more usually associated with MP types of aeroplanes, and regularly operate within the same airspace. The level of knowledge required to operate safely in this environment is not part of, or not included to the necessary depth of knowledge in the training syllabi for the PPL, CPL or IR(A) but these licence holders may fly as PIC of such aeroplanes. The additional theoretical knowledge required to operate such aeroplanes safely is obtained by completion of a course at an ATO.

(b) The aim of the theoretical knowledge course is to provide the applicant with sufficient knowledge of those aspects of the operation of aeroplanes capable of operating at high speeds and altitudes, and the aircraft systems necessary for such operation.

COURSE SYLLABUS

(c) The course will be divided in a VFR and an IFR part, and should cover at least the following items of the aeroplane syllabus to the ATPL(A) level:

FOR VFR OPERATION:

Subject Ref.:	**Syllabus Content:**
021 00 00 00	**AIRCRAFT GENERAL KNOWLEGDE: AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**
021 02 02 01 to 021 02 02 03	Alternating current: general Generators AC power distribution
021 01 08 03	Pressurisation (Air driven systems - piston engines)
021 01 09 04	Pressurisation (Air driven systems - turbojet and turbo propeller)
021 03 01 06 021 03 01 07 021 03 01 08 021 03 01 09	Engine performance - piston engines Power augmentation (turbo or supercharging) Fuel Mixture
021 03 02 00 to 021 03 04 09	Turbine engines
021 04 05 00	Aircraft oxygen equipment
032 03 00 00	**Performance class B: ME aeroplanes**

032 03 01 00 to 032 03 04 01	Performance of ME aeroplanes not certificated under CS and FAR 25: entire subject
040 00 00 00	**HUMAN PERFORMANCE**
040 02 01 00 to 040 02 01 03	Basic human physiology and High altitude environment
050 00 00 00	**METEOROLOGY**
050 02 07 00 to 050 02 08 01	Jet streams CAT Standing waves
050 09 01 00 to 050 09 04 05	Flight hazards Icing and turbulence Thunderstorms
062 02 00 00	**Basic radar principles**
062 02 01 00 to 062 02 05 00	Basic radar principles Airborne radar SSR
081 00 00 00	**PRINCIPLES OF FLIGHT: AEROPLANES**
081 02 01 00 to 081 02 03 02	Transonic aerodynamics: entire subject Mach number or shockwaves buffet margin or aerodynamic ceiling

FOR IFR OPERATIONS

Subject Ref.: **010 00 00 00**	**Syllabus Content** **AIR LAW**
010 06 07 00	Simultaneous Operation on parallel or near-parallel instrument Runways
010 06 08 00	Secondary surveillance radar (transponder) operating procedures
010 09 08 02 **022 00 00 00** 022 02 02 02	Radio altimeter operating areas **AIRCRAFT GENERAL KNOWLEDGE - INSTRUMENTATION** Temperature measurement - Design and operation
022 03 04 00 **022 12 00 00** 022 12 07 00	Flux valve **ALERTING SYSTEMS, PROXIMITY SYSTEMS** Altitude alert system
022 12 08 00 022 12 10 00 022 13 03 01	Radio-altimeter ACAS/TCAS principles and operation Electronic Flight Instrument System (EFIS) — Design, operation
050 00 00 00	**METEOROLOGY**
050 02 06 03 050 10 02 03 **062 00 00 00**	Clear Air turbulence (CAT) - Description, cause and location Upper air charts **RADIO NAVIGATION**
062 02 05 04	ILS — Errors and accuracy

062 02 06 00	MLS
062 02 06 01 to 062 02 06 04	Principles Presentation and Interpretation, Coverage and range Error and accuracy

(d) Demonstration of acquisition of this knowledge is undertaken by passing an examination set by an ATO. A successful pass of this examination results in the issue of a certificate indicating that the course and examination have been completed.

(e) The certificate represents a 'once only' qualification and satisfies the requirement for the addition of all future high performance aeroplanes to the holder's licence. The certificate is valid indefinitely and is to be submitted with the application for the first HPA type or class rating.

(f) A pass in any theoretical knowledge subjects as part of the HPA course will not be credited against meeting future theoretical examination requirements for issue of a CPL(A), IR(A) or ATPL(A).

(g) The applicant who has completed a competency-based modular IR(A) course according to Appendix 6 Aa or EIR course according to FCL.825 needs to complete both VFR and IFR parts of this course.

(h) The applicant who has completed a modular IR(A) course according to Appendix 6 A only needs to complete the VFR part of this course.

FCL.725.A Theoretical knowledge and flight instruction for the issue of class and type ratings — aeroplanes

Unless otherwise determined in the operational suitability data established in accordance with Part-21:

(a) Single-pilot multi-engine aeroplanes.

(1) The theoretical knowledge course for a single-pilot multi-engine class rating shall include at least 7 hours of instruction in multi-engine aeroplane operations.

(2) The flight training course for a single-pilot multi-engine class or type rating shall include at least 2 hours and 30 minutes of dual flight instruction under normal conditions of multi-engine aeroplane operations, and not less than 3 hours 30 minutes of dual flight instruction in engine failure procedures and asymmetric flight techniques.

(b) Single-pilot aeroplanes-sea. The training course for single-pilot aeroplane-sea ratings shall include theoretical knowledge and flight instruction. The flight training for a class or type rating-sea for single-pilot aeroplanes-sea shall include at least 8 hours of dual flight instruction if the applicant holds the land version of the relevant class or type rating, or 10 hours if the applicant does not hold such a rating.

(c) Multi-pilot aeroplanes. The training course for the issue of a multi-pilot aeroplane type rating shall include theoretical knowledge and flight instruction in upset prevention and recovery.

AMC1 FCL.725.A(b) Theoretical knowledge and flight instruction for the issue of class and type ratings — aeroplanes

CLASS RATING SEA

(a) The theoretical knowledge instruction should be conducted by an instructor having appropriate experience of class rating sea.

(b) Depending on the equipment and systems installed, the instruction should include, but not be limited to, the following content:

(1) theoretical knowledge:

(i) the aim of the training is to teach:

(A) the importance of preparation for flight and the safe planning taking into consideration all the factors for manoeuvring the aircraft on the wind, tidal currents, high and low water times and water movements at sea, river estuaries and lakes In addition, icing conditions, ice covered water and broken ice flows;

(B) the techniques about the most critical moments at take-off, landing, taxiing and mooring the aircraft;

(C) the construction methods and characteristics of floats and water rudders and the importance of checking for leaks in the floats;

(D) the necessary requirements for the compliance of the rules for the avoidance of collisions at sea, in regard to sea charts, buoys and lights and horns.

(ii) after completing the training, the student should be able to:

(A) describe the factors that have significance for planning and decision about initiation of seaplane flying and alternative measures for completion of flight;

(B) describe how the water level is affected by air pressure, wind, tide, regularisations and the flight safety depending on changes in the water level;

(C) describe the origin of different ice conditions in water areas;

(D) interpret nautical charts and maps about depths and shoals and risk for water currents, shifts of the wind, turbulence;

(E) decide what required equipment to bring during seaplane flying according to the operational requirements;

(F) describe the origin and extension of water waves, swells and water currents and their effect on the aeroplane;

(G) describe how water and air forces effect the aeroplane on water;

(H) describe the effect of water resistance on the aeroplanes' performance on glassy water and during different wave conditions;

(I) describe the consequences of taxiing with too high engine RPM;

(J) describe the effect of pressure and temperature on performance at take-off and climb from lakes located at higher altitude;

(K) describe the effect of wind, turbulence, and other meteorological conditions of special importance for flight over lakes, islands in mountain areas and other broken ground;

(L) describe the function of the water rudder and its handling, including the effect of lowered water rudder at take-off and landing;

(M) describe the parts of the float installation and their function;

(N) describe the effect of the floats on the aeroplanes' aerodynamics and performance in water and in air;

(O) describe the consequences of water in the floats and fouling of float bottoms;

(P) describe aviation requirements that apply specifically for the conduct of aircraft activity on water;

(Q) describe requirements about animal, nature and environment protection of significance for flight by seaplane, including flight in national parks;

(R) describe the meaning of navigation buoys;

(S) describe the organisation and working methods of the Sea Rescue Service;

(T) describe the requirements in ICAO Annex 2 as set out in paragraph 3.2.6 'Water operation', including relevant parts of the Convention on the International Regulations for Preventing Collisions at Sea.

(2) practical training:

(i) the aim of the practical training is to learn:

(A) the skills in manoeuvring aeroplanes on water and in mooring the aeroplane;

(B) the skills required for the reconnaissance of landing and mooring areas from the air, including the take-off area;

(C) the skills for assessing the effects of different water depths, shoals, wind, height of waves and swell;

(D) the skills for flying with floats about their effect on performance and flight characteristics;

(E) the skills for flying in broken ground during different wind and turbulence conditions;

(F) the skills for take-off and landing on glassy water, different ° of swell and water current conditions.

(ii) after the training, the student should be able to:

(A) handle the equipment that shall be brought during seaplane flying;

(B) perform pre-flight daily inspection on aeroplane, float installation and special seaplane equipment, including emptying of floats;

(C) sail, taxi and turn the aeroplane at swell with correct handling of the water rudder;

(D) taxi on the step and perform turns;

(E) establish the wind direction with the aeroplane;

(F) take necessary actions if loss of steering ability and person falling overboard;

(G) make land and moor aeroplane at bridge, buoy and beach with the use of appropriate knots to secure the aircraft;

(H) maintain given rate of descent by means of variometer only;

(I) perform take-off and landing on glassy water with and without outer references;

(J) perform take-off and landing under swell;

(K) perform power-off landing;

(L) from the air, reconnaissance of landing, mooring and take-off areas, observing;

(M) wind direction and strength during landing and take-off;

(N) surrounding terrain;

(O) overhead wires and other obstacles above and under water;

(P) congested areas;

(Q) determine wind direction and assess wind strength from water level and when airborne;

(R) state, for the aeroplane type in question;

(a) maximum wave height allowed;

(b) maximum number of ERPM allowed during taxi;

(S) describe how flying with floats affects the performance and flight characteristics of the aeroplane;

(T) take corrective action at critical moments due to wind shear and turbulence;

(U) navigate on the water with reference to buoys markers, obstacles and other traffic on the water.

(c) For the initial issue of class rating sea for SP, SE and ME aeroplanes, the number of multi-choice questions in the written or computer-based examination should at least comprise thirty questions, and may be conducted by the training organisation. The pass mark should be 75 %.

FCL.730.A Specific requirements for pilots undertaking a zero flight time type rating (ZFTT) course — aeroplanes

(a) A pilot undertaking instruction at a ZFTT course shall have completed, on a multi-pilot turbo-jet aeroplane certificated to the standards of CS-25 or equivalent airworthiness code or on a multi-pilot turbo-prop aeroplane having a maximum certificated take-off mass of not less than 10 tonnes or a certificated passenger seating configuration of more than 19 passengers, at least:

(1) if an FFS qualified to level CG, C or interim C is used during the course, 1 500 hours flight time or 250 route sectors;

(2) if an FFS qualified to level DG or D is used during the course, 500 hours flight time or 100 route sectors.

(b) When a pilot is changing from a turbo-prop to a turbo-jet aeroplane or from a turbo-jet to a turbo-prop aeroplane, additional simulator training shall be required.

FCL.735.A Multi-crew cooperation training course — aeroplanes

(a) The MCC training course shall comprise at least:

(1) 25 hours of theoretical knowledge instruction and exercises; and

(2) 20 hours of practical MCC training, or 15 hours in the case of student pilots attending an ATP integrated course.

An FNPT II MCC or an FFS shall be used. When the MCC training is combined with initial type rating training, the practical MCC training may be reduced to no less than 10 hours if the same FFS is used for both the MCC and type rating training.

(b) The MCC training course shall be completed within 6 months at an ATO.

(c) Unless the MCC course has been combined with a type rating course, on completion of the MCC training course the applicant shall be given a certificate of completion.

(d) An applicant having completed MCC training for any other category of aircraft shall be exempted from the requirement in (a)(1).

AMC1 FCL.735.A; FCL.735.H ; FCL.735.As

MULTI-CREW COOPERATION COURSE

(a) Competency is a combination of knowledge, skills and attitudes required to perform a task to the prescribed standard.

(b) The objectives of MCC training are to develop the technical and non-technical components of the knowledge, skills and attitudes required to operate a multi-crew aircraft.

(c) Training should comprise both theoretical and practical elements and be designed to achieve the following competencies:

Competency	Performance indicators	Knowledge	Practical exercises
Communication	(a) Know what, how much and who to communicate to; (b) Ensure the recipient is ready and able to receive the information; (c) Pass messages and information clearly, accurately, timely and adequately; (d) Check if the other person has the correct understanding when passing important information; (e) Listen actively, patiently and demonstrate understanding when receiving information; (f) Ask relevant and effective questions, and offer suggestions;	(a) Human Factors, TEM and CRM; (b) Application of TEM and CRM principles to training.	In a commercial air transport environment, apply multi-crew procedures, including principles of TEM and CRM to the following: (a) Pre-flight preparation: (1) FMS initialisation; (2) radio and navigation equipment preparation; (3) flight documentation; (4) Computation of take-off performance data.

	(g) Use appropriate body language, eye contact and tone; (h) Open and receptive to other people's view.		(b) Take-off and climb: (1) before take-off checks; (2) normal take-offs; (3) rejected take-offs; (4) take-offs with abnormal and emergency situations included. (c) Cruise: emergency descent.
Leadership and team working	(a) Friendly, enthusiastic, motivating and considerate of others; (b) Use initiative, give direction and take responsibility when required; (c) Open and honest about thoughts, concerns and intentions; (d) Give and receive criticism and praise well, and admit mistakes; (e) Confidently do and say what is important to him or her; (f) Demonstrate respect and tolerance towards other people; (g) Involve others in planning and share activities fairly.		(d) Descent and approach: (1) instrument flight procedures; (2) holding; (3) precision approach using raw data; (4) precision approach using flight director; (5) precision approach using autopilot; (6) one-engine-inoperative approach; (7) non-precision and circling approaches; (8) computation of approach and landing data; (9) all engines go-around; (10) go-around with one engine inoperative;
Situation awareness	(a) Aware of what the aircraft and its systems are doing;		

	(b) Aware of where the aircraft is and its environment; (c) Keep track of time and fuel; (d) Aware of the condition of people involved in the operation including passengers; (e) Recognise what is likely to happen, plan and stay ahead of the game; (f) Develop what-if scenarios and make pre-decisions; (g) Identify threats to the safety of the aircraft and of the people.		(11) wind shear during approach. (e) landing: transition from instrument to visual flight on reaching decision altitude or height or minimum descent altitude or height; (f) after landing and post flight procedures; (g) selected emergency and abnormal procedures.
Workload management	(a) Calm, relaxed, careful and not impulsive; (b) Prepare, prioritise and schedule tasks effectively; (c) Use time efficiently when carrying out tasks; (d) Offer and accept assistance, delegate when necessary and ask for help early; (e) Review and monitor and cross-check actions conscientiously; (f) Follow procedures appropriately and consistently; (g) Concentrate on one thing at a time, ensure tasks are completed and does not become distracted;		

	(h) Carry out instructions as directed.		
Problem solving and decision making	(a) Identify and verify why things have gone wrong and do not jump to conclusions or make assumptions; (b) Seek accurate and adequate information from appropriate resources; (c) Persevere in working through a problem; (d) Use and agree an appropriate decision making process; (e) Agree essential and desirable criteria and prioritises; (f) Consider as many options as practicable; (g) Make decisions when they need to, reviews and changes if required; (h) Consider risks but do not take unnecessary risks.		
Monitoring and cross-checking	(a) Monitor and cross-checks all actions; (b) Monitor aircraft trajectory in critical flight phases; (c) Take appropriate actions in response to deviations from the flight path.	(a) SOPs; (b) Aircraft systems; (c) Undesired aircraft states.	
Task sharing	(a) Apply SOPs in both PF and PNF roles; (b) Makes and responds to standard callouts.	(a) PF and PNF roles; (b) SOPs.	
Use of checklists	Utilise checklists appropriately according to SOPs.	(a) SOPs; (b) Checklist philosophy.	

Briefings	Prepare and deliver appropriate briefings.	(a) SOPs; (b) Interpretation of FMS data and in-flight documentation.	
Flight management	(a) Maintain a constant awareness of the aircraft automation state; (b) Manage automation to achieve optimum trajectory and minimum workload; (c) Take effective recovery actions from automation anomalies; (d) Manage aircraft navigation, terrain clearance; (e) Manage aircraft fuel state and take appropriate actions.	(a) Understanding of aircraft performance and configuration; (b) Systems; (c) SOPs; (d) Interpretation of FMS data and in-flight documentation; (e) Minimum terrain clearance; (F) Fuel management IFR and VFR regulation.	
FMS use	Programme, manage and monitor FMS in accordance with SOPs.	(a) Systems (FMS); (b) SOPs; (c) Automation.	
Systems normal operations	Perform and monitor normal systems operation in accordance with SOPs.	(a) Systems; (b) SOPs.	
Systems abnormal and emergency operations	(a) Perform and monitor abnormal systems operation in accordance with SOPs; (b) Utilise electronic and paper abnormal checklists in accordance with SOPs.	(a) Systems; (b) SOPs; (c) Emergency and abnormal procedures and checklists; (d) Recall items.	
Environment, weather and ATC	(a) Communicate effectively with ATC; (b) Avoid misunderstandings by requesting clarification; (c) Adhere to ATC instructions;	(a) Systems; (b) SOPs; (c) ATC environment and phraseology; (d) Procedures for hazardous	

	(d) Construct a mental model of the local ATC and weather environment.	weather conditions.	

CERTIFICATE OF COMPLETION FORM

CERTIFICATE OF COMPLETION OF MCC-TRAINING

Applicant's last name(s):			First name(s):	
Type of licence:			Number:	State:
ME/IR:		**OR**	ME/IR skill test:	
Issued on:			passed on:	
	Signature of applicant:			

The satisfactory completion of MCC-Training according to requirements is certified below:

TRAINING			
Multi-crew co-operation training received during period:			
from:	to:	at:	ATO / operator*
Location and date:		Signature of head of ATO or authorised instructor*:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

** Delete as appropriate*

FCL.740.A Revalidation of class and type ratings — aeroplanes

(a) Revalidation of multi-engine class ratings and type ratings. For revalidation of multi-engine class ratings and type ratings, the applicant shall:

(1) pass a proficiency check in accordance with Appendix 9 to this Part in the relevant class or type of aeroplane or an FSTD representing that class or type, within the 3 months immediately preceding the expiry date of the rating; and

(2) complete during the period of validity of the rating, at least:

(i) 10 route sectors as pilot of the relevant class or type of aeroplane; or

(ii) 1 route sector as pilot of the relevant class or type of aeroplane or FFS, flown with an examiner. This route sector may be flown during the proficiency check.

(3) A pilot working for a commercial air transport operator approved in accordance with the applicable air operations requirements who has passed the operators proficiency check combined with the proficiency check for the revalidation of the class or type rating shall be exempted from complying with the requirement in (2).

(4) The revalidation of an en route instrument rating (EIR) or an IR(A), if held, may be combined with a proficiency check for the revalidation of a class or type rating.

(b) Revalidation of single-pilot single-engine class ratings.

(1) Single-engine piston aeroplane class ratings and TMG ratings. For revalidation of single-pilot single-engine piston aeroplane class ratings or TMG class ratings the applicant shall:

(i) within the 3 months preceding the expiry date of the rating, pass a proficiency check in the relevant class in accordance with Appendix 9 to this Part with an examiner; or

(ii) within the 12 months preceding the expiry date of the rating, complete 12 hours of flight time in the relevant class, including:

— 6 hours as PIC,

— 12 take-offs and 12 landings, and

— refresher training of at least 1 hour of total flight time with a flight instructor (FI) or a class rating instructor (CRI). Applicants shall be exempted from this refresher training if they have passed a class or type rating proficiency check, skill test or assessment of competence in any other class or type of aeroplane.

(2) When applicants hold both a single-engine piston aeroplane-land class rating and a TMG rating, they may complete the requirements of (1) in either class or a combination thereof, and achieve revalidation of both ratings.

(3) Single-pilot single-engine turbo-prop aeroplanes. For revalidation of single-engine turbo-prop class ratings applicants shall pass a proficiency check on the relevant class in accordance

with Appendix 9 to this Part with an examiner, within the 3 months preceding the expiry date of the rating.

(4) When applicants hold both a single-engine piston aeroplane-land class rating and a single-engine piston aeroplane-sea class rating, they may complete the requirements of (1)(ii) in either class or a combination thereof, and achieve the fulfilment of these requirements for both ratings. At least 1 hour of required PIC time and 6 of the required 12 take-offs and landings shall be completed in each class.

(c) Applicants who fail to achieve a pass in all sections of a proficiency check before the expiry date of a class or type rating shall not exercise the privileges of that rating until a pass in the proficiency check has been achieved.

SECTION 3 - Specific requirements for the helicopter category

FCL.720.H Experience requirements and prerequisites for the issue of type ratings — helicopters

Unless otherwise determined in the operational suitability data established in accordance with Part-21, an applicant for the issue of the first helicopter type rating shall comply with the following experience requirements and prerequisites for the issue of the relevant rating:

(a) Multi-pilot helicopters. An applicant for the first type rating course for a multi-pilot helicopter type shall:

(1) have at least 70 hours as PIC on helicopters;

(2) except when the type rating course is combined with an MCC course:

(i) hold a certificate of satisfactory completion of an MCC course in helicopters; or

(ii) have at least 500 hours as a pilot on multi-pilot aeroplanes; or

(iii) have at least 500 hours as a pilot in multi-pilot operations on multi- engine helicopters;

(3) have passed the ATPL(H) theoretical knowledge examinations.

(b) An applicant for the first type rating course for a multi-pilot helicopter type who is a graduate from an ATP(H)/IR, ATP(H), CPL(H)/IR or CPL(H) integrated course and who does not comply with the requirement of (a)(1), shall have the type rating issued with the privileges limited to exercising functions as co-pilot only. The limitation shall be removed once the pilot has:

(1) completed 70 hours as PIC or pilot-in-command under supervision of helicopters;

(2) passed the multi-pilot skill test on the applicable helicopter type as PIC.

(c) Single-pilot multi-engine helicopters. An applicant for the issue of a first type rating for a single-pilot multi-engine helicopter shall:

(1) before starting flight training:

(i) have passed the ATPL(H) theoretical knowledge examinations; or

(ii) hold a certificate of completion of a pre-entry course conducted by an ATO. The course shall cover the following subjects of the ATPL(H) theoretical knowledge course:

— Aircraft General Knowledge: airframe/systems/power plant, and instrument/electronics,

— Flight Performance and Planning: mass and balance, performance;

(2) in the case of applicants who have not completed an ATP(H)/IR, ATP(H), or CPL(H)/IR integrated training course, have completed at least 70 hours as PIC on helicopters.

FCL.735.H Multi-crew cooperation training course — helicopters

(a) The MCC training course shall comprise at least:

(1) for MCC/IR:

(i) 25 hours of theoretical knowledge instruction and exercises; and

(ii) 20 hours of practical MCC training or 15 hours, in the case of student pilots attending an ATP(H)/IR integrated course. When the MCC training is combined with the initial type rating training for a multi-pilot helicopter, the practical MCC training may be reduced to not less than 10 hours if the same FSTD is used for both MCC and type rating;

(2) for MCC/VFR:

(i) 25 hours of theoretical knowledge instruction and exercises; and

(ii) 15 hours of practical MCC training or 10 hours, in the case of student pilots attending an ATP(H)/IR integrated course. When the MCC training is combined with the initial type rating training for a multi-pilot helicopter, the practical MCC training may be reduced to not less than 7 hours if the same FSTD is used for both MCC and type rating.

(b) The MCC training course shall be completed within 6 months at an ATO.

An FNPT II or III qualified for MCC, an FTD 2/3 or an FFS shall be used.

(c) Unless the MCC course has been combined with a multi-pilot type rating course, on completion of the MCC training course the applicant shall be given a certificate of completion.

(d) An applicant having completed MCC training for any other category of aircraft shall be exempted from the requirement in (a)(1)(i) or (a)(2)(i), as applicable.

(e) An applicant for MCC/IR training who has completed MCC/VFR training shall be exempted from the requirement in (a)(1)(i), and shall complete 5 hours of practical MCC/IR training.

AMC1 FCL.735.A; FCL.735.H ; FCL.735.As

GM1 to Appendix 3; Appendix 6; FCL.735.H

OVERVIEW OF FSTD TRAINING CREDITS FOR DUAL INSTRUCTION IN HELICOPTER FLYING TRAINING COURSES

		ATPL(H)/IR integrated			FSTD credits
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual, including ME T/R training	75 hrs	15 hrs	40 hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III

Basic instrument	10 hrs	-	-	10 hrs	20 hrs FFS or FTD 2, 3 or FNPT II/III or 10 hrs in at least an FNPT I
Instrument rating training	40 hrs	-		40 hrs	
MCC	15 hrs	-	-	15 hrs	15 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
Total	140 hrs	55 hrs		195 hrs	65 hrs FFS or 60 hrs FTD 2, 3 or 55 hrs FNPT II/III or 10 hrs in at least an FNPT I
		ATPL(H)/VFR integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual including ME T/R training	75 hrs	15 hrs	40 hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
MCC / VFR	10 hrs	-	-	10 hrs	10 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
Total	95 hrs	55 hrs		150 hrs	40 hrs FFS or 35 hrs FTD 2, 3 or 30 hrs FNPT II/III or 5 hrs in at least an FNPT I
		CPL(H)/IR integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual including ME T/R training	75 hrs	15 hrs	40hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	20 hrs FFS or FTD 2, 3 or FNPT II/III or 10 hrs in at least an FNPT I
Instrument rating training	40 hrs	-		40 hrs	

Total	125 hrs	55 hrs		180 hrs	50 hrs FFS C/D level or 45 hrs FTD 2, 3 or 40 hrs FNPT II/III or 10 hrs in at least an FNPT I

		CPL(H) Integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual	75 hrs	15 hrs	35 hrs	125 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
Total	85 hrs	50 hrs		135 hrs	35 hrs FFS or 30 hrs FTD 2, 3 or 25 hrs FNPT II/III or 5 hrs in at least an FNPT I
		CPL(H) modular			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual	20 hrs	-	-	20 hrs	5 hrs FFS or FTD 2, 3 or FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
Total	30 hrs	-	-	30 hrs	10 hrs FFS or FTD 2,3 or FNPT II/III or 5 hrs in at least an FNPT I
		IR(H) modular			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
SE	50 hrs	-	-	50 hrs	35 hrs FFS or FTD 2, 3 or FNPT II/III or 20 hrs FNPT I (H) or (A)
ME	55 hrs	-	-	55 hrs	40 hrs FFS; FTD 2, 3 FNPT II/III or 20 hrs FNPT I (H) or (A)

		MCC(H)			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
MCC / IR	20 hrs	-	-	20 hrs	20 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
MCC / VFR	15 hrs	-	-	15 hrs	15 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
MCC / IR for MCC/VFR holders	5 hrs	-	-	5 hrs	5 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)

Note: In this matrix FSTD credits refer to helicopter FSTDs if not mentioned otherwise.

FCL.740.H Revalidation of type ratings — helicopters

(a) Revalidation. For revalidation of type ratings for helicopters, the applicant shall:

(1) pass a proficiency check in accordance with Appendix 9 to this Part in the relevant type of helicopter or an FSTD representing that type within the 3 months immediately preceding the expiry date of the rating; and

(2) complete at least 2 hours as a pilot of the relevant helicopter type within the validity period of the rating. The duration of the proficiency check may be counted towards the 2 hours.

(3) When applicants hold more than 1 type rating for single-engine piston helicopters, they may achieve revalidation of all the relevant type ratings by completing the proficiency check in only 1 of the relevant types held, provided that they have completed at least 2 hours of flight time as PIC on the other types during the validity period.

The proficiency check shall be performed each time on a different type.

(4) When applicants hold more than 1 type rating for single-engine turbine helicopters with a maximum certificated take-off mass up to 3 175 kg, they may achieve revalidation of all the relevant type ratings by completing the proficiency check in only 1 of the relevant types held, provided that they have completed:

(i) 300 hours as PIC on helicopters;

(ii) 15 hours on each of the types held; and

(iii) at least 2 hours of PIC flight time on each of the other types during the validity period.

The proficiency check shall be performed each time on a different type.

(5) A pilot who successfully completes a skill test for the issue of an additional type rating shall achieve revalidation for the relevant type ratings in the common groups, in accordance with (3) and (4).

(6) The revalidation of an IR(H), if held, may be combined with a proficiency check for a type rating.

(b) An applicant who fails to achieve a pass in all sections of a proficiency check before the expiry date of a type rating shall not exercise the privileges of that rating until a pass in the proficiency check has been achieved. In the case of (a)(3) and (4), the applicant shall not exercise his/her privileges in any of the types.

AMC1 FCL.740.H(a)(3) Revalidation of type ratings — helicopters

Only the following SEP helicopter types can be considered for crediting of the proficiency check. Other SEP helicopters (for example the R22 and R44) should not be given credit for.

Manufacturer	**Helicopter type and licence endorsement**
Agusta-Bell	
SEP	Bell47
Bell Helicopters	
SEP	Bell47
Brantley	
SEP	Brantley B2
Breda Nardi	
SEP	HU269
Enstrom	
SEP	ENF28
Hélicoptères Guimbal	
SEP	Cabri G2
Hiller	
SEP	UH12
Hughes or Schweizer	
SEP	HU269
Westland	
SEP	Bell47

SECTION 4 - Specific requirements for the powered-lift aircraft category

FCL.720.PL Experience requirements and prerequisites for the issue of type ratings — powered-lift aircraft

Unless otherwise determined in the operational suitability data established in accordance with Part-21, an applicant for the first issue of a powered-lift type rating shall comply with the following experience requirements and prerequisites:

(a) for pilots of aeroplanes:

(1) hold a CPL/IR(A) with ATPL theoretical knowledge or an ATPL(A);

(2) hold a certificate of completion of an MCC course;

(3) have completed more than 100 hours as pilot on multi-pilot aeroplanes;

(4) have completed 40 hours of flight instruction in helicopters;

(b) for pilots of helicopters:

(1) hold a CPL/IR(H) with ATPL theoretical knowledge or an ATPL/IR(H);

(2) hold a certificate of completion of an MCC course;

(3) have completed more than 100 hours as a pilot on multi-pilot helicopters;

(4) have completed 40 hours of flight instruction in aeroplanes;

(c) for pilots qualified to fly both aeroplanes and helicopters:

(1) hold at least a CPL(H);

(2) hold an IR and ATPL theoretical knowledge or an ATPL in either aeroplanes or helicopters;

(3) hold a certificate of completion of an MCC course in either helicopters or aeroplanes;

(4) have completed at least 100 hours as a pilot on multi-pilot helicopters or aeroplanes;

(5) have completed 40 hours of flight instruction in aeroplanes or helicopters, as applicable, if the pilot has no experience as ATPL or on multi-pilot aircraft.

GM1 FCL.720.PL Experience requirements and prerequisites for the issue of type ratings — powered-lift aircraft

The endorsement of a powered-lift type rating to an aeroplane or helicopter licence does not confer upon its holder the privileges to fly helicopters or aeroplanes, respectively.

FCL.725.PL Flight instruction for the issue of type ratings — powered-lift aircraft

The flight instruction part of the training course for a powered-lift type rating shall be completed in both the aircraft and an FSTD representing the aircraft and adequately qualified for this purpose.

FCL.740.PL Revalidation of type ratings — powered-lift aircraft

(a) Revalidation. For revalidation of powered-lift type ratings, the applicant shall:

(1) pass a proficiency check in accordance with Appendix 9 to this Part in the relevant type of powered-lift within the 3 months immediately preceding the expiry date of the rating;

(2) complete during the period of validity of the rating, at least:

(i) 10 route sectors as pilot of the relevant type of powered-lift aircraft; or

(ii) 1 route sector as pilot of the relevant type of powered-lift aircraft or FFS, flown with an examiner. This route sector may be flown during the proficiency check.

(3) A pilot working for a commercial air transport operator approved in accordance with the applicable air operations requirements who has passed the operators proficiency check combined with the proficiency check for the revalidation of the type rating shall be exempted from complying with the requirement in (2).

(b) An applicant who fails to achieve a pass in all sections of a proficiency check before the expiry date of a type rating shall not exercise the privileges of that rating until the a pass in the proficiency check has been achieved.

Go back to Subpart H
Go back to the content

SECTION 5 - Specific requirements for the airship category

FCL.720.As Prerequisites for the issue of type ratings — airships

Unless otherwise determined in the operational suitability data established in accordance with Part-21, an applicant for the first issue of an airship type rating shall comply with the following experience requirements and prerequisites:

(a) for multi-pilot airships:

(1) have completed 70 hours of flight time as PIC on airships;

(2) hold a certificate of satisfactory completion of MCC on airships.

(3) An applicant who does not comply with the requirement in (2) shall have the type rating issued with the privileges limited to exercising functions as co-pilot only. The limitation shall be removed once the pilot has completed 100 hours of flight time as PIC or pilot-in-command under supervision of airships.

FCL.735.As Multi-crew cooperation training course — airships

(a) The MCC training course shall comprise at least:

(1) 12 hours of theoretical knowledge instruction and exercises; and

(2) 5 hours of practical MCC training;

An FNPT II, or III qualified for MCC, an FTD 2/3 or an FFS shall be used.

(b) The MCC training course shall be completed within 6 months at an ATO.

(c) Unless the MCC course has been combined with a multi-pilot type rating course, on completion of the MCC training course the applicant shall be given a certificate of completion.

(d) An applicant having completed MCC training for any other category of aircraft shall be exempted from the requirements in (a).

AMC1 FCL.735.A; FCL.735.H ; FCL.735.As

FCL.740.As Revalidation of type ratings — airships

(a) Revalidation. For revalidation of type ratings for airships, the applicant shall:

(1) pass a proficiency check in accordance with Appendix 9 to this Part in the relevant type of airship within the 3 months immediately preceding the expiry date of the rating; and

(2) complete at least 2 hours as a pilot of the relevant airship type within the validity period of the rating. The duration of the proficiency check may be counted towards the 2 hours.

(3) The revalidation of an IR(As), if held, may be combined with a proficiency check for the revalidation of a class or type rating.

(b) An applicant who fails to achieve a pass in all sections of a proficiency check before the expiry date of a type rating shall not exercise the privileges of that rating until a pass in the proficiency check has been achieved.

SUBPART I - ADDITIONAL RATINGS

FCL.800 Aerobatic rating

(a) Holders of a pilot licence for aeroplanes, TMG or sailplanes shall only undertake aerobatic flights when they hold the appropriate rating.

(b) Applicants for an aerobatic rating shall have completed:

(1) at least 40 hours of flight time or, in the case of sailplanes, 120 launches as PIC in the appropriate aircraft category, completed after the issue of the licence;

(2) a training course at an ATO, including:

(i) theoretical knowledge instruction appropriate for the rating;

(ii) at least 5 hours or 20 flights of aerobatic instruction in the appropriate aircraft category.

(c) The privileges of the aerobatic rating shall be limited to the aircraft category in which the flight instruction was completed. The privileges will be extended to another category of aircraft if the pilot holds a licence for that aircraft category and has successfully completed at least 3 dual training flights covering the full aerobatic training syllabus in that category of aircraft.

AMC1 FCL.800 Aerobatic rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

(a) The aim of the aerobatic training is to qualify licence holders to perform aerobatic manoeuvres.

(b) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) human factors and body limitation:

(i) spatial disorientation;

(ii) airsickness;

(iii) body stress and G-forces, positive and negative;

(iv) effects of grey- and blackouts.

(2) technical subjects:

(i) legislation affecting aerobatic flying to include environmental and noise subjects;

(ii) principles of aerodynamics to include slow flight, stalls and spins, flat and inverted;

(iii) general airframe and engine limitations (if applicable).

(3) limitations applicable to the specific aircraft category (and type):

(i) air speed limitations (aeroplane, helicopter, TMG and sailplane, as applicable);

(ii) symmetric load factors (type-related, as applicable);

(iii) rolling Gs (type-related, as applicable).

(4) aerobatic manoeuvres and recovery:

(i) entry parameters;

(ii) planning systems and sequencing of manoeuvres;

(iii) rolling manœuvres;

(iv) looping manœuvres;

(v) combination manœuvres;

(vi) entry and recovery from developed spins, flat, accelerated and inverted.

(5) emergency procedures:

(i) recovery from unusual attitudes;

(ii) drills to include the use of parachutes (if worn) and aircraft abandonment.

(d) Flying training

The exercises of the aerobatic flying training syllabus should be repeated as necessary until the applicant achieves a safe and competent standard. Having completed the flight training, the student pilot should be able to perform a solo flight containing a sequence of aerobatic manoeuvres. The dual training and the supervised solo training flights should be tailored to the category of aircraft and limited to the permitted manoeuvres of that type of aircraft. The exercises should comprise at least the following practical training items:

(1) confidence manoeuvres and recoveries:

(i) slow flights and stalls;

(ii) steep turns;

(iii) side slips;

(iv) engine restart in-flight (if applicable);

(v) spins and recovery;

(vi) recovery from spiral dives;

(vii) recovery from unusual attitudes.

(2) aerobatic manoeuvres:

(i) Chandelle;

(ii) Lazy Eight;

(iii) rolls;

(iv) loops;

(v) inverted flight;

(vi) Hammerhead turn;

(vii) Immelmann.

FCL.805 Sailplane towing and banner towing ratings

(a) Holders of a pilot licence with privileges to fly aeroplanes or TMGs shall only tow sailplanes or banners when they hold the appropriate sailplane towing or banner towing rating.

(b) Applicants for a sailplane towing rating shall have completed:

(1) at least 30 hours of flight time as PIC and 60 take-offs and landings in aeroplanes, if the activity is to be carried out in aeroplanes, or in TMGs, if the activity is to be carried out in TMGs, completed after the issue of the licence;

(2) a training course at an ATO including:

(i) theoretical knowledge instruction on towing operations and procedures;

(ii) at least 10 instruction flights towing a sailplane, including at least 5 dual instruction flights; and

(iii) except for holders of an LAPL(S) or an SPL, 5 familiarisation flights in a sailplane which is launched by an aircraft.

(c) Applicants for a banner towing rating shall have completed:

(1) at least 100 hours of flight time and 200 take-offs and landings as PIC on aeroplanes or TMG, after the issue of the licence. At least 30 of these hours shall be in aeroplanes, if the activity is to be carried out in aeroplanes, or in TMG, if the activity is to be carried out in TMGs;

(2) a training course at an ATO including:

(i) theoretical knowledge instruction on towing operations and procedures;

(ii) at least 10 instruction flights towing a banner, including at least 5 dual flights.

(d) The privileges of the sailplane and banner towing ratings shall be limited to aeroplanes or TMG, depending on which aircraft the flight instruction was completed. The privileges will be extended if the pilot holds a licence for aeroplanes or TMG and has successfully completed at least 3 dual training flights covering the full towing training syllabus in either aircraft, as relevant.

(e) In order to exercise the privileges of the sailplane or banner towing ratings, the holder of the rating shall have completed a minimum of 5 tows during the last 24 months.

(f) When the pilot does not comply with the requirement in (e), before resuming the exercise of his/her privileges, the pilot shall complete the missing tows with or under the supervision of an instructor.

AMC1 FCL.805 Sailplane towing and banner towing rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

(a) The aim of the towing instruction is to qualify licence holders to tow banners or sailplanes.

(b) The ATO should issue a certificate of satisfactory completion of the instruction that can be used for licence endorsement.

(c) Theoretical knowledge: towing of sailplanes

The theoretical knowledge syllabus for towing of sailplanes should cover the revision or explanation of:

(1) regulations about towing flights;

(2) equipment for the towing activity;

(3) sailplane towing techniques, including:

(i) signals and communication procedures;

(ii) take-off (normal and crosswind);

(iii) in-flight launch procedures;

(iv) descending on tow;

(v) sailplane release procedure;

(vi) tow rope release procedure;

(vii) landing with tow rope connected (if applicable);

(viii) emergency procedures during tow, including equipment malfunctions;

(ix) safety procedures;

(x) flight performance of the applicable aircraft type when towing sailplanes;

(xi) look-out and collision avoidance;

(xii) performance data sailplanes, including:

(A) suitable speeds;

(B) stall characteristics in turns.

(d) Theoretical knowledge: banner towing

The theoretical knowledge syllabus for banner towing should cover the revision or explanation of:

(1) regulations about banner towing;

(2) equipment for the banner towing activity;

(3) ground crew coordination;

(4) pre-flight procedures;

(5) banner towing techniques, including:

(i) take-off launch;

(ii) banner pickup manoeuvres;

(iii) flying with a banner in tow;

(iv) release procedure;

(v) landing with a banner in tow (if applicable);

(vi) emergency procedures during tow, including equipment malfunctions;

(vii) safety procedures;

(viii) flight performance of the applicable aircraft type when towing a heavy or light banner;

(ix) prevention of stall during towing operations.

(e) Flying training: towing of sailplanes

The exercises of the towing training syllabus for towing sailplanes should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items:

(1) take-off procedures (normal and crosswind take-offs);

(2) 360 ° circles on tow with a bank of 30 ° and more;

(3) descending on tow;

(4) release procedure of the sailplane;

(5) landing with the tow rope connected (if applicable);

(6) tow rope release procedure in-flight;

(7) emergency procedures (simulation);

(8) signals and communication during tow.

(f) Flying training: banner towing

The exercises of the towing training syllabus for banner towing should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items:

(1) pickup manoeuvres;

(2) towing in-flight techniques;

(3) release procedures;

(4) flight at critically low air speeds;

(5) maximum performance manoeuvres;

(6) emergency manoeuvres to include equipment malfunctions (simulated);

(7) specific banner towing safety procedures;

(8) go-around with the banner connected;

(9) loss of engine power with the banner attached (simulated).

FCL.810 Night rating

(a) Aeroplanes, TMGs, airships.

(1) If the privileges of an LAPL, an SPL or a PPL for aeroplanes, TMGs or airships are to be exercised in VFR conditions at night, applicants shall have completed a training course at an ATO. The course shall comprise:

(i) theoretical knowledge instruction;

(ii) at least 5 hours of flight time in the appropriate aircraft category at night, including at least 3 hours of dual instruction, including at least 1 hour of cross-country navigation with at least one dual cross- country flight of at least 50 km (27 NM) and 5 solo take-offs and 5 solo full-stop landings.

(2) Before completing the training at night, LAPL holders shall have completed the basic instrument flight training required for the issue of the PPL.

(3) When applicants hold both a single-engine piston aeroplane (land) and a TMG class rating, they may complete the requirements in (1) above in either class or both classes.

(b) Helicopters. If the privileges of a PPL for helicopters are to be exercised in VFR conditions at night, the applicant shall have:

(1) completed at least 100 hours of flight time as pilot in helicopters after the issue of the licence, including at least 60 hours as PIC on helicopters and 20 hours of cross-country flight;

(2) completed a training course at an ATO. The course shall be completed within a period of 6 months and comprise:

(i) 5 hours of theoretical knowledge instruction;

(ii) 10 hours of helicopter dual instrument instruction time; and

(iii) 5 hours of flight time at night, including at least 3 hours of dual instruction, including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing.

(3) An applicant who holds or has held an IR in an aeroplane or TMG, shall be credited with 5 hours towards the requirement in (2)(ii) above.

(c) Balloons. If the privileges of an LAPL for balloons or a BPL are to be exercised in VFR conditions at night, applicants shall complete at least 2 instruction flights at night of at least 1 hour each.

AMC1 FCL.810(b) Night rating

PPL(H) NIGHT RATING COURSE

(a) The aim of the course is to qualify PPL(H) holders to exercise the privileges of the licence at night.

(b) The ATO should issue a certificate of satisfactory completion of the instruction that can be used for licence endorsement.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) night VMC minima;

(2) rules about airspace control at night and facilities available;

(3) rules about aerodrome ground, runway, landing site and obstruction lighting;

(4) aircraft navigation lights and collision avoidance rules;

(5) physiological aspects of night vision and orientation;

(6) dangers of disorientation at night;

(7) dangers of weather deterioration at night;

(8) instrument systems or functions and errors;

(9) instrument lighting and emergency cockpit lighting systems;

(10) map marking for use under cockpit lighting;

(11) practical navigation principles;

(12) radio navigation principles;

(13) planning and use of safety altitude;

(14) danger from icing conditions, avoidance and escape manoeuvres.

(d) Flying training

The exercises of the night rating flight syllabus should be repeated as necessary until the student achieves a safe and competent standard:

(1) In all cases, exercises 4 to 6 of the night rating flight syllabus should be completed.

(2) For exercises 1 to 3, up to 50 % of the required flight training may be completed in an FSTD(H). However, all items within each exercise should be conducted in a helicopter in-flight.

(3) Items marked (*) should be completed in simulated IMC and may be completed in daylight.

(4) The flying exercises should comprise:

(i) Exercise 1:

(A) revise basic manoeuvres when flying by sole reference to instruments*;

(B) explain and demonstrate transition to instrument flight from visual flight*;

(C) explain and revise recovery from unusual attitudes by sole reference to instruments*.

(ii) Exercise 2:

Explain and demonstrate the use of radio navigation aids when flying by sole reference to instruments, to include position finding and tracking*.

(iii) Exercise 3:

Explain and demonstrate the use of radar assistance*.

(iv) Exercise 4:

(A) explain and demonstrate the use and adjustment of landing light;

(B) explain and demonstrate night hovering:

(a) higher and slower than by day;

(b) avoidance of unintended sideways or backwards movements.

(C) explain and demonstrate night take-off techniques;

(D) explain and demonstrate night circuit technique;

(E) explain and demonstrate night approaches (constant angle) with or without visual approach aids to:

(a) heliports;

(b) illuminated touchdown areas.

(F) practise take-off's, circuits and approaches;

(G) explain and demonstrate night emergency procedures to include:

(a) simulated engine failure (to be terminated with power recovery at a safe altitude);

(b) simulated engine failure, including SE approach and landing (ME only);

(c) simulated inadvertent entry to IMC (not on base leg or final);

(d) simulated hydraulic control failure (to include landing);

(e) internal and external lighting failure;

(f) other malfunctions and emergency procedures as required by the aircraft flight manual.

(v) Exercise 5:

Solo night circuits.

(vi) Exercise 6:

(A) explain and demonstrate night cross-country techniques;

(B) practise night cross-country dual and as SPIC to a satisfactory standard.

FCL.815 Mountain rating

(a) Privileges. The privileges of the holder of a mountain rating are to conduct flights with aeroplanes or TMG to and from surfaces designated as requiring such a rating by the appropriate authorities designated by the Member States.

The initial mountain rating may be obtained either on:

(1) wheels, to grant the privilege to fly to and from such surfaces when they are not covered by snow; or

(2) skis, to grant the privilege to fly to and from such surfaces when they are covered by snow.

(3) The privileges of the initial rating may be extended to either wheel or ski privileges when the pilot has undertaken an appropriate additional familiarisation course, including theoretical knowledge instruction and flight training, with a mountain flight instructor.

(b) Training course. Applicants for a mountain rating shall have completed, within a period of 24 months, a course of theoretical knowledge instruction and flight training at an ATO. The content of the course shall be appropriate to the privileges sought.

(c) Skill test. After the completion of the training, the applicant shall pass a skill test with an FE qualified for this purpose. The skill test shall contain:

(1) a verbal examination of theoretical knowledge;

(2) 6 landings on at least 2 different surfaces designated as requiring a mountain rating other than the surface of departure.

(d) Validity. A mountain rating shall be valid for a period of 24 months.

(e) Revalidation. For revalidation of a mountain rating, the applicant shall:

(1) have completed at least 6 mountain landings in the past 24 months; or

(2) pass a proficiency check. The proficiency check shall comply with the requirements in (c).

(f) Renewal. If the rating has lapsed, the applicant shall comply with the requirement in (e)(2).

AMC1 FCL.815 Mountain rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

THEORETICAL KNOWLEDGE	
WHEEL	SKI
1. Equipment	
W.1.1 Personal equipment for the flight W.1.2 Aircraft equipment for the flight	S.1.1 Personal equipment for the flight S.1.2 Aircraft equipment for the flight
2. Take-off techniques	
W.2.1 Technique for approach and landing on a mountain surface	S.2.1 Technique for approach and landing on a mountain surface S.2.2 Landing technique on skis
W.2.2 Rolling techniques of the aircraft on various runway profiles	S.2.3 Rolling techniques of the aircraft on skis about the snow nature
W.2.3 Take-off technique	S.2.4 Take-off technique on surfaces covered with snow
W.2.4 Aircraft and engine performances about altitude	S.2.5. Aircraft and engine performances about altitude
3. Rules	
W.3.1 Mountain rating W.3.2 Overflight rules W.3.3 Surfaces classification W.3.4 PIC responsibilities W.3.5 Responsibilities of the surface manager W.3.6 Flight plan	S.3.1 Mountain rating S.3.2 Overflight rules S.3.3 Surfaces classification S.3.4 PIC responsibilities S.3.5 Responsibilities of the surface manager S.3.6 Flight plan S.3.7 Certification of the ski mounted aeroplanes
4. Meteorology	
W.4.1 Movements of the air mass W.4.2 Flight consequences W.4.3 Relief effect on the movement of the air masses W.4.4 Altimetry	S.4.1 Movements of the air mass S.4.2 Flight consequences S.4.3 Relief effect on the movement of the air masses S.4.4 Altimetry
5. Human Performance and Limitations	
W.5.1 The cold W.5.2 The food W.5.3 The hypoxia W.5.4 The radiance W.5.5 The thirst W.5.6 The tiredness W.5.7 Turbulence effects in altitude	S.5.1 The cold S.5.2 The food S.5.3 The hypoxia S.5.4 The radiance S.5.5 The thirst S.5.6 The tiredness S.5.7 Turbulence effects in altitude
6. Navigation	
W.6.1 Progress of the flight W.6.2 Dead reckoning W.6.3 The path over the relief	S.6.1 Progress of the flight S.6.2 Dead reckoning S.6.3 The path over the relief
W.6.4 Progress in the valleys	S.6.4 Progress in the valleys

W.6.5 Detection of obstacles (high voltage lines, chairlifts, cables, etc.).	S.6.5 Detection of obstacles (high voltage lines, chairlifts, cables, etc.)
7. Specific items	
	S.7.1 Knowledge of the snow and assessment of the snow nature in-flight S.7.2 Knowledge of the glacier S.7.3 Life of the glacier S.7.4 Formation of the cracks S.7.5 Snow bridges S.7.6 Avalanches
8. Survival	
	S.8.1 Ways of survival (psychological aspects) S.8.2 Use of the equipments S.8.3 Removal of snow from the aircraft S.8.4 Building of a shelter S.8.5 How to eat and feed
FLIGHT INSTRUCTION	
WHEEL	SKI
I.- Navigation	
W.I.1 Flight techniques in the valleys W.I.2 Flight over mountain passes and ridges W.I.3 U-turn in narrow valleys W.I.4 Choice of the flight path of aerology W.I.5 Map reading	S.I.I Flight techniques in the valleys S.I.2 Flight over mountain passes and ridges. S.I.3 U-turn in narrow valleys S.I.4 Choice of the flight path of aerology S.I.5 Map reading
II. – Arrival and reconnaissance	
W.II.1 Choice of the altitude of arrival W.II.2 Choice of the arrival and overflight pattern W.II.3 Choice of the landing pattern W.II.4 Aerology awareness W.II.5 Evaluation of the length of the runway W.II.6 Evaluation of the runway profile (slope and banking) W.II.7 Collision avoidance. W.II.8 Definition of the references for the landing (touchdown point) W.II.9 Determination of the circuit pattern altitude W.II.10 Choice of the final speed depending on the runway profile	S.II.1 Choice of the arrival altitude S.II.2 Choice of the arrival and overflight pattern S.II.3 Description of the circuit pattern S.II.4 Aerology awareness S.II.5 Evaluation of the runway length S.II.6 Evaluation of the runway profile (slope and banking) S.II.7 Collision avoidance S.II.8 Definition of the references for the landing (touchdown point) S.II.9 Determination of the circuit pattern altitude S.II.10 Choice of the final speed depending on the runway profile S.II.11 Choice of the take-off axis S.II.12. Choice of the landing axis S.II.13 Choice of the parking area S.II.14 Observation of the obstacles on the ground (cracks, snow bridges, avalanches) S.II.15 Estimation of the snow nature

	S.II.16 Observation of the way to reach a refuge from the landing area
III – Approach and landing	
W.III.1 Landing pattern altitude W.III.2 Precision of flight along the landing path W.III.3 Corrections on the landing path (accuracy and effectiveness) W.III.4 Landing (precision of the flare and of the touchdown point) W.III.5 Taxiing (use of the engine power) on various profiles W.III.6 Parking of the aircraft (depending on the runway profile, the traffic, etc.)	S.III.1 Landing pattern altitude S.III.2 Precision of flight along the landing path S.III.3 Corrections on the landing path (accuracy and effectiveness) S.III.4 Landing (precision of the flare and of the touchdown point) S.III.5 Taxi of the aircraft on various snows and various runway profiles S.III.6 Parking of the aircraft (depending on the snow nature and the profile of the apron) S.III.7 Turns on various snow nature and various ground profiles
IV. – Take-off	
W.IV.1 Safety checks before take-off W.IV.2 Lining up on the runway W.IV.3 Control of the runway axis during take-off W.IV.4 Choice and use of the visual references of the take-off axis	S. IV.1 Safety checks before take-off. S.IV.2 Lining up on the runway S.IV.3 Control of the runway axis during take-off S.IV.4 Choice and use of the visual references of the take-off axis S.IV.5 Acceleration depending on the nature of the snow S.IV.6 Short take-off S.IV.7 Take-off avoiding the skid of the skis
V. - Survival	
	S.V.1 Use of the snowshoes S.V.2 Use of the markings

AMC2 FCL.815 Mountain rating

SKILL TEST AND PROFICIENCY CHECK

The skill test for the issue or the proficiency check for the revalidation or renewal of a mountain rating should contain the following elements:

(a) oral examination

This part should be done before the flight and should cover all the relevant parts of the theoretical knowledge. At least one question for each of the following sections should be asked:

(1) specific equipment for a mountain flight (personal and aircraft);

(2) rules of the mountain flight.

If the oral examination reveals a lack in theoretical knowledge, the flight test should not be done and the skill test is failed.

(b) practical skill test

During the flight test, two sites different from the departure airport should be used for recognition, approach, landing and take-off. For the mountain rating ski or the extension from wheel to ski, one of the two different sites should be a glacier.

FCL.820 Flight test rating

(a) Holders of a pilot licence for aeroplanes or helicopters shall only act as PIC in category 1 or 2 flight tests, as defined in Part-21, when they hold a flight test rating.

(b) The obligation to hold a flight test rating established in (a) shall only apply to flight tests conducted on:

(1) helicopters certificated or to be certificated in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes; or

(2) aeroplanes certificated or to be certificated in accordance with:

(i) the standards of CS-25 or equivalent airworthiness codes; or

(ii) the standards of CS-23 or equivalent airworthiness codes, except for aeroplanes with an maximum take-off mass of less than 2 000 kg.

(c) The privileges of the holder of a flight test rating are to, within the relevant aircraft category:

(1) in the case of a category 1 flight test rating, conduct all categories of flight tests, as defined in Part-21, either as PIC or co-pilot;

(2) in the case of a category 2 flight test rating:

(i) conduct category 1 flight tests, as defined in Part-21:

— as a co-pilot, or

— as PIC, in the case of aeroplanes referred to in (b)(2)(ii), except for those within the commuter category or having a design diving speed above 0,6 mach or a maximum ceiling above 25 000 feet;

(ii) conduct all other categories of flight tests, as defined in Part-21, either as PIC or co-pilot;

(3) conduct flights without a type or class rating as defined in Subpart H, except that the flight test rating shall not be used for commercial air transport operations.

(d) Applicants for the first issue of a flight test rating shall:

(1) hold at least a CPL and an IR in the appropriate aircraft category;

(2) have completed at least 1 000 hours of flight time in the appropriate aircraft category, of which at least 400 hours as PIC;

(3) have completed a training course at an ATO appropriate to the intended aircraft and category of flights. The training shall cover at least the following subjects:

— Performance,

— Stability and control/Handling qualities,

— Systems,

— Test management,

— Risk/Safety management.

(e) The privileges of holders of a flight test rating may be extended to another category of flight test and another category of aircraft when they have completed an additional course of training at an ATO.

AMC1 FCL.820 Flight test rating

TRAINING COURSE

GENERAL

(a) Competency-based training:

(1) Training courses for the flight test rating should be competency-based. The training programme should follow as much as possible the syllabus outlined below, but may be adapted taking into account the previous experience, skill and theoretical knowledge level of the applicants.

(2) It should also be recognised that the syllabi below assume that suitable flight test experience will be gained subsequent to attendance at the course. Should the applicant be significantly experienced already, then consideration should be made of that experience and it is possible that course content might be reduced in areas where that experience has been obtained.

(3) Furthermore, it should be noted that flight test ratings are specific to both a certain category of aircraft (aeroplanes or helicopters) and to a certain category of flight test (category 1 or 2). Therefore, holders of a flight test rating wishing to extend their privileges to further categories of aircraft or to further categories of flight test (this is only relevant for holders of a category 2 flight test rating since the category one flight test rating includes the privileges for category 2 test flights) should not be requested to undertake the same course as an 'ab-initio' applicant. In these cases, the ATO should develop specific 'bridge courses' taking into account the same principles mentioned above.

(4) To allow proper consideration of the applicant's previous experience, a pre-entry assessment of the applicant's skills should be undertaken by the applicant, on the basis of which the ATO may evaluate the level of the applicant to better tailor the course. Thus, the syllabi listed below should be regarded as a list of individual demonstrable competencies and qualifications rather than a list of mandatory training objectives.

(b) Continuous evaluation

Training courses for the flight test rating should be built on a continuous evaluation model to guarantee that successful completion of the course ensures that the applicant has reached the level of competence (both theoretical and practical) to be issued a flight test rating.

CONTENT OF THE COURSE

(c) In addition, the content of the course should vary taking into account whether the applicant seeks privileges for a category 1 or 2 flight test rating, as well as the relevant category of aircraft, and their level of complexity. To better take these factors into account, training courses for the flight test rating have been divided into two conditions:

(1) condition 1 courses apply to category 1 flight test ratings on:

(i) helicopters certificated in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;

(ii) aeroplanes certificated in accordance with:

(A) the standards of CS-25 or equivalent airworthiness codes; or

(B) the standards of CS-23 or equivalent airworthiness codes, within the commuter category or having an M_D above 0.6 or a maximum ceiling above 25 000 ft.

(2) condition 2 training courses apply to:

(i) category 2 flight test ratings for:

(A) helicopters certificated in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;

(B) aeroplanes certificated in accordance with:

(a) the standards of CS-25 or equivalent airworthiness codes; or

(b) the standards of CS-23 or equivalent airworthiness codes (included those mentioned in (c)(1)(ii)(B)), except for aeroplanes with a maximum take-off mass of less than 2 000 kg.

(ii) category 1 flight tests for aeroplanes certificated in accordance with the standards of CS-23, with a maximum take-off mass of more than 2 000kg, with the exclusion of those mentioned in (c)(1)(ii)(B) (which are subject to condition 1 courses).

AEROPLANES

(d) Condition 1 courses for aeroplanes

(1) These courses should include approximately:

(i) 350 hours of ground training;

(ii) 100 hours of flight test training, during which at least 15 flights should be made without an instructor on board;

(iii) principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least 10 different aeroplane types, of which at least one should be certificated in accordance with CS-25 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least five substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 1 - AEROPLANES		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) climb ME; (3) take-off and landing, including turboprop or turbofan OEI.
	(b) engines	Turboprop or turbofan limitations and relight envelope
	(c) handling qualities (at least two flight test reports should be developed)	(1) flight controls characteristics; (2) longitudinal handling qualities; (3) longitudinal manoeuvre stability; (4) take-off and landing MET or ME turbofan, including v_{mcg} and v_{mu}; (5) lateral, directional handling qualities; (6) handling qualities evaluation; (7) variable stability demo flights including HOFCS; (8) stalls; (9) spins; (10) v_{mca}.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) autopilot or AFCS; (2) glass cockpit evaluation; (3) radio navigation, instruments qualification and integrated avionics; (4) TAWS; (5) ACAS.
	(e) high speed certification test	

	(f) final evaluation exercise (a flight test report should be developed)

(e) Condition 2 courses for aeroplanes

(1) These courses should include approximately:

(i) 150 hours of ground training;

(ii) 50 hours of flight test training, during which at least eight flights should be made without an instructor on board.

Principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least seven different aeroplane types, of which at least one should be certificated in accordance with CS-25 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least three substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 2 - AEROPLANES		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) climb ME; (3) take-off and landing MET or ME turbofan.
	(b) handling qualities	(1) flight control characteristics; (2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities; (4) stalls; (5) spins.

	(c) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) autopilot or AFCS; (2) glass cockpit evaluation; (3) radio navigation, instruments qualification and integrated avionics; (4) TAWS; (5) ACAS.
	(d) final evaluation exercise (a) flight test report should be developed)	

HELICOPTERS

(f) Condition 1 courses for helicopters:

(1) These courses should include approximately:

(i) 350 hours of ground training;

(ii) 100 hours of flight test training, during which at least 20 flights should be made without an instructor on board.

Principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least eight different helicopter types, of which at least one should be certificated in accordance with CS-29 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least five substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 1 - HELICOPTERS		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance:	(1) air speed calibration; (2) level flight, climb and descent, vertical and hover performance;

	(at least one flight test report should be developed)	
	(b) engines	(1) digital engine governing; (2) turbine or piston engine evaluation.
	(c) handling qualities (at least one flight test report should be developed)	(1) flight control characteristics; (2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities; (4) ADS 33; (5) teetering rotor assessment; (6) rigid rotor assessment; (7) variable stability demo flights including HOFCS.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) navigation management systems; (2) autopilot or AFCS; (3) night vision goggles or electro-optics; (4) glass cockpit evaluation;
	(e) height and velocity envelope and EOL, including relights	
	(f) category A procedure	
	(g) vibrations and rotor adjustments	
	(h) auto rotations	
	(i) final evaluation exercise (a flight test report should be developed)	

(g) Condition 2 courses for helicopters

(1) These courses should include approximately:

(i) 150 hours of ground training;

(ii) 50 hours of flight test training, during which at least eight flights should be made without an instructor on board.

Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least four different helicopters types, of which at least one should be certificated in accordance with CS-29 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least three substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 2 - HELICOPTERS		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) level flight, climb and descent, vertical and hover performance.
	(b) engines	(1) digital engines governing; (2) turbine or piston engine evaluation.
	(c) handling qualities	(1) flight control characteristics; (2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) navigation management systems; (2) autopilot or AFCS; (3) night vision goggles or electro-optics; (4) glass cockpit evaluation.
	(e) vibration and rotor adjustments	
	(f) final evaluation exercise (a flight test report should be developed)	

FCL.825 En route instrument rating (EIR)

(a) Privileges and conditions

(1) The privileges of the holder of an en route instrument rating (EIR) are to conduct flights by day under IFR in the en route phase of flight, with an aeroplane for which a class or type rating is held. The privilege may be extended to conduct flights by night under IFR in the en route phase of flight if the pilot holds a night rating in accordance with FCL.810.

(2) The holder of the EIR shall only commence or continue a flight on which he/she intends to exercise the privileges of his/her rating if the latest available meteorological information indicates that:

(i) the weather conditions on departure are such as to enable the segment of the flight from take-off to a planned VFR-to-IFR transition to be conducted in compliance with VFR; and

(ii) at the estimated time of arrival at the planned destination aerodrome, the weather conditions will be such as to enable the segment of the flight from an IFR-to-VFR transition to landing to be conducted in compliance with VFR.

(b) Prerequisites. Applicants for the EIR shall hold at least a PPL(A) and shall have completed at least 20 hours of cross-country flight time as PIC in aeroplanes.

(c) Training course. Applicants for an EIR shall have completed, within a period of 36 months at an ATO:

(1) at least 80 hours of theoretical knowledge instruction in accordance with FCL.615; and

(2) instrument flight instruction, during which:

(i) the flying training for a single-engine EIR shall include at least 15 hours of instrument flight time under instruction; and

(ii) the flying training for a multi-engine EIR shall include at least 16 hours of instrument flight time under instruction, of which at least 4 hours shall be in multi-engine aeroplanes.

(d) Theoretical knowledge. Prior to taking the skill test, the applicant shall demonstrate a level of theoretical knowledge appropriate to the privileges granted, in the subjects referred to in FCL.615(b).

(e) Skill test. After the completion of the training, the applicant shall pass a skill test in an aeroplane with an IRE. For a multi-engine EIR, the skill test shall be taken in a multi-engine aeroplane. For a single-engine EIR, the test shall be taken in a single-engine aeroplane.

(f) By way of derogation from points (c) and (d), the holder of a single-engine EIR who also holds a multi-engine class or type rating wishing to obtain a multi-engine EIR for the first time, shall complete a course at an ATO comprising at least 2 hours instrument flight time under instruction in the en route phase of flight in multi-engine aeroplanes and shall pass the skill test referred to in point (e).

(g) Validity, revalidation, and renewal.

(1) An EIR shall be valid for 1 year.

(2) Applicants for the revalidation of an EIR shall:

(i) pass a proficiency check in an aeroplane within a period of 3 months immediately preceding the expiry date of the rating; or

(ii) within 12 months preceding the expiry date of the rating, complete 6 hours as PIC under IFR and a training flight of at least 1 hour with an instructor holding privileges to provide training for the IR(A) or EIR.

(3) For each alternate subsequent revalidation, the holder of the EIR shall pass a proficiency check in accordance with point (g)(2)(i).

(4) If an EIR has expired, in order to renew their privileges applicants shall:

(i) complete refresher training provided by an instructor holding privileges to provide training for the IR(A) or EIR to reach the level of proficiency needed; and

(ii) complete a proficiency check.

(5) If the EIR has not been revalidated or renewed within 7 years from the last validity date, the holder will also be required to pass again the EIR theoretical knowledge examinations in accordance with FCL.615(b).

(6) For a multi-engine EIR, the proficiency check for the revalidation or renewal, and the training flight required in point (g)(2)(ii) have to be completed in a multi-engine aeroplane. If the pilot also holds a single- engine EIR, this proficiency check shall also achieve revalidation or renewal of the single-engine EIR. The training flight completed in a multi-engine aeroplane shall also fulfil the training flight requirement for the single-engine EIR.

(h) When the applicant for the EIR has completed instrument flight time under instruction with an IRI(A) or an FI(A) holding the privilege to provide training for the IR or EIR, these hours may be credited towards the hours required in point (c)(2)(i) and (ii) up to a maximum of 5 or 6 hours respectively. The 4 hours of instrument flight instruction in multi-engine aeroplanes required in point (c)(2)(ii) shall not be subject to this credit.

(1) To determine the amount of hours to be credited and to establish the training needs, the applicant shall complete a pre-entry assessment at the ATO.

(2) The completion of the instrument flight instruction provided by an IRI(A) or FI(A) shall be documented in a specific training record and signed by the instructor.

(i) Applicants for the EIR, holding a Part-FCL PPL or CPL and a valid IR(A) issued in accordance with the requirements of Annex 1 to the Chicago Convention by a third country, may be credited in full towards the training course requirements mentioned in point (c). In order to be issued the EIR, the applicant shall:

(1) successfully complete the skill test for the EIR;

(2) by way of derogation from point (d), demonstrate during the skill test towards the examiner that he/she has acquired an adequate level of theoretical knowledge of air law, meteorology and flight planning and performance (IR);

(3) have a minimum experience of at least 25 hours of flight time under IFR as PIC on aeroplanes.

AMC1 FCL.825(a) En Route instrument rating (EIR)

GENERAL

Since the privileges of the EIR are only to be exercised in the en route phase of flight, holders of an EIR should:

(a) at no time accept an IFR clearance to fly a departure, arrival or approach procedure;

(b) notify the ATS if unable to complete a flight within the limitations of their rating.

CONDITIONS FOR THE EXERCISE OF THE PRIVILEGES OF AN EN ROUTE INSTRUMENT RATING (EIR)

(c) To comply with FCL.825(a)(2), the holder of an EIR should not commence or continue a flight during which it is intended to exercise the privileges of the rating unless the appropriate weather reports or forecasts for the destination and alternate aerodrome for the period from one hour before until one hour after the planned time of arrival indicates VMC. The flight may be planned only to aerodromes for which such meteorological information is available. When filing a flight plan, the holder of an EIR should include suitable VFR to IFR and IFR to VFR transitions. In any case, the pilot needs to apply the relevant operational rules, which ever are more limiting.

(d) A suitable VFR to IFR transition is any navigational fix

(1) to which the flight can be safely conducted under VFR; and

(2) which is acceptable to ATS if available.

(e) A suitable IFR to VFR transition is any navigational fix

(1) to which the flight can be safely conducted under IFR;

(2) at which VMC conditions exist; and

(3) from where the flight can be safely continued under VFR without having to follow instrument arrival or approach procedures.

AMC1 FCL.825(c) En route instrument rating (EIR)

FLYING TRAINING

The flight instruction for the EIR should comprise the following flying exercises:

(a) pre-flight procedures for IFR flights, including the use of the flight manual, meteorological information, appropriate air traffic service documents, filing of an IFR flight plan, including VFR/IFR transitions and diversions;

(b) use of appropriate IFR and VFR charts;

(c) basic instrument flight by sole reference to instruments:

— horizontal flight,

— climbing,

— descending,

— turns in level flight, climbing, descending;

(d) steep turns and recovery from unusual attitudes on full and limited panel;

(e) normal flight on limited panel;

(f) instrument pattern;

(g) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

— transition from visual to instrument flight after departure,

— en route IFR procedures,

— en route holding procedures,

— transition from instrument flight en route to visual before reaching the Minimum Sector Altitude (MSA);

(h) radio navigation (GPS/VOR);

(i) use of advanced equipment such as autopilot, flight director, stormscope, de-icing equipment, EFIS or radar, as available;

(j) emergency procedures covering the deterioration of meteorological conditions;

(k) at least two IFR approaches in the context of an emergency situation;

(l) use of RT techniques in order to gain a competence to a high standard;

(m) if required, operation of a multi-engine aeroplane during the above range of exercises to include engine failures and cruise flight with one engine simulated inoperative;

(n) the flight instruction should also include at least two flights in controlled airspace under IFR with a high density of traffic and VFR arrivals and departures from aerodromes with a mixture of instrument and visual traffic.

AMC2 FCL.825(d) En route instrument rating (EIR)

THEORETICAL KNOWLEDGE INSTRUCTION AND EXAMINATION

(a) GENERAL

The theoretical knowledge instruction and examination is the same as for the instrument rating following the competency-based modular course according to Appendix 6 Aa.

(b) THEORETICAL KNOWLEDGE

The applicant should complete an approved competency-based IR(A) or EIR theoretical knowledge (TK) course. The approved CB-IR(A) or EIR TK course may contain computer-based training, e-learning elements, interactive video, slide/tape presentation, learning carrels and other media as approved by the authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom teaching, as required by ORA.ATO.305, has to be provided.

(c) THEORETICAL KNOWLEDGE EXAMINATION

The number of questions per subject, the distribution of questions and the time allocated to each subject is detailed in AMC2 ARA.FCL.300(b).

GM1 FCL.825(d) En route instrument rating (EIR)

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES FOR EIR

For the detailed theoretical knowledge syllabus and learning objectives, refer to GM1 FCL.615(b).

AMC1 FCL.825(e); (g) En route instrument rating (EIR)

SKILL TEST/PROFICIENCY CHECK FOR THE ISSUE, REVALIDATION, OR RENEWAL OF AN EN ROUTE INSTRUMENT RATING (EIR)

(a) An applicant for an EIR should have received instrument flight instruction on the same type or class of aeroplane to be used in the test/check.

(b) An applicant should pass all the relevant sections of the skill test/proficiency check. If any item in a section is failed, that section is failed. Failure in more than one section will require the applicant to take the entire test/check again. An applicant failing only one section should only repeat the failed section. Failure in any section of the retest/recheck, including those sections that have been passed on a previous attempt, requires the applicant to take the entire test/check again. All sections of the skill test/proficiency check should be completed within six months. Failure to achieve a pass in all sections of the test/check in two attempts requires further training.

(c) Further training may be required following a failed skill test/proficiency check. There is no limit to the number of skill tests/proficiency checks that may be attempted.

CONDUCT OF THE TEST/CHECK

(d) The test/check is intended to simulate a practical flight. The route to be flown shall be chosen by the examiner. An essential element is the ability of the applicant to plan and conduct the flight from routine briefing material. The applicant should undertake the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The duration of the flight should be at least 60 minutes.

(e) Should the applicant choose to terminate a skill test/proficiency check for reasons considered inadequate by the flight examiner, the applicant should retake the entire skill test/proficiency check. If the test/check is terminated for reasons considered adequate by the examiner, only those sections not completed should be tested in a further flight.

(f) At the discretion of the examiner any manoeuvre or procedure of the test/check may be repeated once by the applicant. The examiner may stop the test/check at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest/recheck.

(g) An applicant should fly the aeroplane from a position where the pilot-in-command functions can be performed and to carry out the test/check as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

(h) Minimum descent heights/altitudes and the transition points should be determined by the applicant and agreed by the examiner.

(i) An applicant for an EIR should indicate to the examiner the checks and duties carried out, including the identification of radio facilities. The checks should be completed in accordance with the authorised checklist for the aeroplane on which the test/check is being taken. During pre-flight preparation for the test/check the applicant should determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane used.

FLIGHT TEST TOLERANCES

(j) The applicant should demonstrate the ability to:

– operate the aeroplane within its limitations;

– complete all manoeuvres with smoothness and accuracy;

– exercise good judgment and airmanship;

– apply aeronautical knowledge; and

– maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(k) The following limits should apply, corrected to make allowance for turbulent conditions, and the handling qualities and performance of the aeroplane used

Height

Generally ±100 feet

Tracking

on radio aids ±10°

Heading

all engines operating ±10° with simulated engine failure ±15°

Speed

all engines operating +10 knots/–5 knots with simulated engine failure +15 knots/–5 knots

CONTENT OF THE SKILL TEST/PROFICIENCY CHECK

SECTION 1

PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of checklist, airmanship, anti/de-icing procedures, etc., apply in all sections.	
a	Use of flight manual (or equivalent) especially a/c performance calculation, mass and balance
b	Use of ATC document, weather document
c	Preparation of ATC flight plan, IFR flight plan/log
d	Pre-flight inspection
e	Weather Minima
f	Taxiing
g	Pre-take-off briefing. Take-off
h	ATC liaison: compliance, R/T procedures
SECTION 2 GENERAL HANDLING	
a	Control of the aeroplane by reference solely to instruments, including: level flight at various speeds, trim
b	Climbing and descending turns with sustained Rate 1 turn
c	Recoveries from unusual attitudes, including sustained 45° bank turns and steep descending turns
d	Recovery from approach to stall in level flight, climbing/descending turns and in landing configuration
e	Limited panel, stabilised climb or descent at Rate 1 turn onto given headings, recovery from unusual attitudes
SECTION 3 EN ROUTE IFR PROCEDURES	
a	Transition to instrument flight
b	Tracking, including interception, e.g. NDB, VOR, RNAV
c	Use of radio aids
d	Level flight, control of heading, altitude and airspeed, power setting, trim technique
e	Altimeter settings
f	Timing and revision of ETAs (En route hold — if required)
g	Monitoring of flight progress, flight log, fuel usage, systems management
h	Simulated emergency situation(s)
i	Ice protection procedures, simulated if necessary
j	Simulated diversion to alternate aerodrome
k	Transition to visual flight
l	ATC liaison and compliance, R/T procedures
SECTION 4	
	Intentionally left blank
SECTION 5	
a	Setting and checking of navigational aids, identification of facilities
b	Arrival procedures, altimeter settings
c	Approach and landing briefing, including descent/approach/landing checks
d	Visual landing
e	ATC liaison: compliance, R/T procedures
SECTION 6 (multi-engine aeroplanes only) Flight with one engine inoperative	
a	Simulated engine failure during en route phase of flight
b	ATC liaison: compliance, R/T procedures

AMC1 FCL.825(g)(2)) En route instrument rating (EIR)

TRAINING FLIGHT FOR REVALIDATION

(a) The training flight for the revalidation of an EIR should be based on the exercise items of the EIR proficiency check as deemed relevant by the instructor and should depend on the experience of the candidate. The training flight should include a briefing including a discussion on threat and error management with a special emphasis on decision making when encountering adverse meteorological conditions, unintentional Instrument Meteorological Conditions (IMC) and navigation flight capabilities.

(b) In any case, a simulated diversion and instrument approach to an alternate aerodrome in the context of an emergency situation during the en route phase in IFR should be demonstrated by the instructor.

AMC1 FCL.825(h) En route instrument rating (EIR)

PRE-ENTRY ASSESSMENT AND TRAINING RECORD

(a) PRE-ENTRY ASSESSMENT

The assessment to establish the amount of training to be credited and to identify the training needs should be based on the EIR training syllabus established in AMC1 FCL.825(c).

(b) TRAINING RECORD

(1) Before initiating the assessment, the applicant should provide the ATO with a training record containing the details of the previous flight training provided by the IRI(A) or the FI(A). This training record should at least specify the aircraft type and registration used for the training, the number of flights and the total amount of instrument flight time under instruction. It should also specify all the exercises completed during the training by using the syllabus contained in AMC1 FCL.825(c).

(2) The instructor(s) having provided the training should keep the training records containing all the details of the flight training given for a period of at least 5 years after the completion of the training.

AMC2 FCL.825(h) En route instrument rating (EIR)

TRAINING AIRCRAFT

The aeroplane used for the instrument flight time under instruction provided outside an ATO by an IRI(A) or FI(A) should be:

(a) fitted with primary flight controls that are instantly accessible by both the student and the instructor (for example dual flight controls or a centre control stick). Swing-over flight controls should not be used; and

(b) suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required.

AMC1 FCL.825(i) En route instrument rating (EIR)

CREDITING ON THE BASIS OF A THIRD COUNTRY IR(A) RATING

In order to be credited in full towards the multi-engine EIR training course requirements, the applicant should:

(a) hold a multi-engine IR(A), issued in accordance with the requirements of Annex 1 to the Chicago Convention by a third country;

(b) have the minimum experience required in FCL.825 paragraph (i)(3), of which at least 4 hours should be completed in a multi-engine aeroplane.

FCL.830 Sailplane Cloud Flying Rating

(a) Holders of a pilot licence with privileges to fly sailplanes shall only operate a sailplane or a powered sailplane, excluding TMG, within cloud when they hold a sailplane cloud flying rating.

(b) Applicants for a sailplane cloud flying rating shall have completed at least:

(1) 30 hours as PIC in sailplanes or powered sailplanes after the issue of the licence;

(2) a training course at an ATO including:

(i) theoretical knowledge instruction; and

(ii) at least 2 hours of dual flight instruction in sailplanes or powered sailplanes, controlling the sailplane solely by reference to instruments, of which a maximum of one hour may be completed on TMGs; and

(3) a skill test with an FE qualified for this purpose.

(c) Holders of an EIR or an IR(A) shall be credited against the requirement of (b)(2)(i). By way of derogation from point (b)(2)(ii), at least one hour of dual flight instruction in a sailplane or powered sailplane, excluding TMG, controlling the sailplane solely by reference to instruments shall be completed.

(d) Holders of a cloud flying rating shall only exercise their privileges when they have completed in the last 24 months at least 1 hour of flight time, or 5 flights as PIC exercising the privileges of the cloud flying rating, in sailplanes or powered sailplanes, excluding TMGs.

(e) Holders of a cloud flying rating who do not comply with the requirements in point (d) shall, before they resume the exercise of their privileges:

(1) undertake a proficiency check with an FE qualified for this purpose; or

(2) perform the additional flight time or flights required in point (d) with a qualified instructor.

(f) Holders of a valid EIR or an IR(A) shall be credited in full against the requirements in point (d).

AMC1 FCL.830 Sailplane Cloud Flying Rating

THEORETICAL KNOWLEDGE INSTRUCTION AND FLIGHT INSTRUCTION

1. THEORETICAL KNOWLEDGE INSTRUCTION

The theoretical knowledge syllabus should cover the revision and/or explanation of:

1.1. Human Factors and Body Limitations

— basic aviation physiology in regards cloud flying aspects

— basic aviation psychology

— spatial disorientation

1.2. Principles of Flight

— stability

— control

— limitations (load factor and manoeuvres)

1.3. Aircraft Instrumentation

— sensors and instruments

— measurement of air data parameters

— gyroscopic instruments

1.4. Navigation

— use of GPS

— use of charts

— dead reckoning navigation (DR)

— air traffic regulations — airspace structure

— aeronautical information service

— Member State regulations regarding cloud flying

1.5. Communications

— VHF communications

— relevant weather information terms

1.6. Hazards and Emergency Procedures

— icing

— cloud escape procedures

— anti-collision instruments/avionics

2. FLYING TRAINING

2.1. The exercises of the sailplane cloud flight instruction syllabus should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items, flown solely by reference to instruments:

— straight flight

— turning

— achieving and maintaining heading

— return to straight flight from steeper angle of bank

— position fixing using GPS and aeronautical charts

— position estimating using DR

— basic cloud escape manoeuvre/unusual attitude

— advanced cloud escape manoeuvre on nominated heading

2.2. Only exercises under simulated IMC should be conducted in a TMG. However, at least one hour cloud flying training must be flown in a sailplane or powered sailplane (excluding TMG).

AMC2 FCL.830 Sailplane Cloud Flying Rating

SKILL TEST AND PROFICIENCY CHECK

The skill test for the issue of the cloud flying rating or the proficiency check for fulfilling the requirements in FCL.830(b)(3) and in FCL.830(e)(1) should be conducted in either a sailplane or a powered sailplane (including TMG if the test or check will be flown under simulated IMC only) and should contain the following elements:

(a) ORAL EXAMINATION

This part should be completed before the flight and should cover all the relevant parts of the theoretical knowledge syllabus. At least one question for each of the following sections should be asked:

— Human performance and body limitations;

— Principles of flight;

— Aircraft instrumentation for cloud flying;

— Navigation;

— Communications;

— Hazards and emergency procedures.

If the oral examination reveals a lack in theoretical knowledge, the flight test should not be done and the skill test/proficiency check is failed.

(b) PRACTICAL SKILL TEST/PROFICIENCY CHECK

During the practical test/check, the following limits should apply with appropriate allowance for turbulent conditions and the handling qualities and performance of the sailplane used. Artificial horizon or turn and slip instruments should be used as appropriate:

	Artificial Horizon	Turn & Slip
Straight flight	Heading + 10o IAS + 10kts	Heading + 20o IAS + 15kts
Turning	Angle of bank + 15o IAS + 10kts	Small deviations in rate of turn with a maximum
		deviation between ½ & full scale IAS + 15ts
Position fixing given: GPS displaying range and bearing to a point	+ 2NM	+ 3NM

During the practical test/check, the following exercises should be successfully completed by the applicant, flown solely by reference to instruments and taking into account the limits above:

— straight flight;

— turning;

— achieving and maintaining heading;

— return to straight flight from steeper angle of bank;

— position fixing using GPS and aeronautical charts;

— position estimating using DR;

— basic cloud escape manoeuvre/unusual attitude;

— advanced cloud escape manoeuvre on nominated heading.

SUBPART J - INSTRUCTORS

SECTION 1 - Common requirements

FCL.900 Instructor certificates

(a) General. A person shall only carry out:

(1) flight instruction in aircraft when he/she holds:

(i) a pilot licence issued or accepted in accordance with this Regulation;

(ii) an instructor certificate appropriate to the instruction given, issued in accordance with this Subpart;

(2) synthetic flight instruction or MCC instruction when he/she holds an instructor certificate appropriate to the instruction given, issued in accordance with this Subpart.

(b) Special conditions:

(1) In the case of introduction of new aircraft in the Member States or in an operator's fleet, when compliance with the requirements established in this Subpart is not possible, the competent authority may issue a specific certificate giving privileges for flight instruction. Such a certificate shall be limited to the instruction flights necessary for the introduction of the new type of aircraft and its validity shall not, in any case, exceed 1 year.

(2) Holders of a certificate issued in accordance with (b)(1) who wish to apply for the issue of an instructor certificate shall comply with the prerequisites and revalidation requirements established for that category of instructor. Notwithstanding FCL.905.TRI(b), a TRI certificate issued in accordance with this (sub)paragraph will include the privilege to instruct for the issue of a TRI or SFI certificate for the relevant type.

(c) Instruction outside the territory of the Member States:

(1) Notwithstanding paragraph (a), in the case of flight instruction provided in an ATO located outside the territory of the Member States, the competent authority may issue an instructor certificate to an applicant holding a pilot licence issued by a third country in accordance with Annex 1 to the Chicago Convention, provided that the applicant:

(i) holds at least an equivalent licence, rating, or certificate to the one for which they are authorised to instruct and in any case at least a CPL;

(ii) complies with the requirements established in this Subpart for the issue of the relevant instructor certificate;

(iii) demonstrates to the competent authority an adequate level of knowledge of European aviation safety rules to be able to exercise instructional privileges in accordance with this Part.

(2) The certificate shall be limited to providing flight instruction:

(i) in ATOs located outside the territory of the Member States;

(ii) to student pilots who have sufficient knowledge of the language in which flight instruction is given.

GM1 FCL.900 Instructor certificates

GENERAL

(a) Nine instructor categories are recognised:

(1) FI certificate: aeroplane (FI(A)), helicopter (FI(H)), airship (FI(As)), sailplane (FI(S)) and balloon (FI(B));

(2) TRI certificate: aeroplane (TRI(A)), helicopter (TRI(H)), powered-lift aircraft (TRI(PL));

(3) CRI certificate: aeroplane (CRI(A));

(4) IRI certificate: aeroplane (IRI(A)), helicopter (IRI(H)) and airship (IRI(As));

(5) SFI certificate: aeroplane (SFI(A)), helicopter (SFI(H)) and powered-lift aircraft (SFI(PL));

(6) MCCI certificate: aeroplanes (MCCI(A)), helicopters (MCCI(H)), powered-lift aircraft(MCCI(PL)) and airships (MCCI(As));

(7) STI certificate: aeroplane (STI(A)) and helicopter (STI(H));

(8) MI certificate: (MI);

(9) FTI certificate: (FTI).

(b) For categories (1) to (4) and for (8) and (9) the applicant needs to hold a pilot licence. For categories (5) to (7) no licence is needed, only an instructor certificate.

(c) A person may hold more than one instructor certificate.

SPECIAL CONDITIONS

(a) When new aircraft are introduced, requirements such as to hold a licence and rating equivalent to the one for which instruction is being given, or to have adequate flight experience, may not be possible to comply with. In this case, to allow for the first instruction courses to be given to applicants for licences or ratings for these aircraft, competent authorities need the possibility to issue a specific certificate that does not have to comply with the requirements established in this Subpart.

(b) The competent authority should only give these certificates to holders of other instruction qualifications. As far as possible, preference should be given to persons with at least 100 hours of experience in similar types or classes of aircraft.

(c) When the new aircraft type introduced in an operator’s fleet already existed in a Member State, the competent authority should only give the specific certificate to an applicant that is qualified as PIC on that aircraft.

(d) The certificate should ideally be limited in validity to the time needed to qualify the first instructors for the new aircraft in accordance with this Subpart, but in any case it should not exceed the 1 year established in the rule.

FCL.915 General prerequisites and requirements for instructors

(a) General. An applicant for an instructor certificate shall be at least 18 years of age.

(b) Additional requirements for instructors providing flight instruction in aircraft. An applicant for or the holder of an instructor certificate with privileges to conduct flight instruction in an aircraft shall:

(1) hold at least the licence and, where relevant, the rating for which flight instruction is to be given;

(2) except in the case of the flight test instructor, have:

(i) completed at least 15 hours of flight time as a pilot on the class or type of aircraft on which flight instruction is to be given, of which a maximum of 7 hours may be in an FSTD representing the class or type of aircraft, if applicable; or

(ii) passed an assessment of competence for the relevant category of instructor on that class or type of aircraft;

(3) be entitled to act as PIC on the aircraft during such flight instruction.

(c) Credit towards further ratings and for the purpose of revalidation:

(1) Applicants for further instructor certificates may be credited with the teaching and learning skills already demonstrated for the instructor certificate held.

(2) Hours flown as an examiner during skill tests or proficiency checks shall be credited in full towards revalidation requirements for all instructor certificates held.

(d) Credit for extension to further types shall take into account the relevant elements as defined in the operational suitability data in accordance with Part-21.

FCL.920 Instructor competencies and assessment

All instructors shall be trained to achieve the following competences:

— Prepare resources,

— Create a climate conducive to learning,

— Present knowledge,

— Integrate Threat and Error Management (TEM) and crew resource management,

— Manage time to achieve training objectives,

— Facilitate learning,

— Assess trainee performance,

— Monitor and review progress,

— Evaluate training sessions,

— Report outcome.

AMC1 FCL.920 Instructor competencies and assessment

(a) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching and assessing threat and error management and CRM.

(b) The training and assessment of instructors should be made against the following performance standards:

Competence	Performance	Knowledge
Prepare resources	(a) ensures adequate facilities; (b) prepares briefing material; (c) manages available tools.	(a) understand objectives; (b) available tools; (c) competency-based training methods.
Create a climate conducive to learning	(a) establishes credentials, role models appropriate behaviour; (b) clarifies roles; (c) states objectives; (d) ascertains and supports trainees needs.	(a) barriers to learning; (b) learning styles.
Present knowledge	(a) communicates clearly; (b) creates and sustains realism; (c) looks for training opportunities.	teaching methods.
Integrate TEM or CRM	makes TEM or CRM links with technical training.	HF, TEM or CRM.
Manage time to achieve training objectives	allocates time appropriate to achieving competency objective.	syllabus time allocation.
Facilitate learning	(a) encourages trainee participation; (b) shows motivating, patient, confident and assertive manner; (c) conducts one-to-one coaching; (d) encourages mutual support.	(a) facilitation; (b) how to give constructive feedback; (c) how to encourage trainees to ask questions and seek advice;
Assesses trainee performance	(a) assesses and encourages trainee self-assessment of performance against competency standards; (b) makes assessment decision and provide clear feedback; (c) observes CRM behaviour.	(a) observation techniques; (b) methods for recording observations.
Monitor and review progress	(a) compares individual outcomes to defined objectives; (b) identifies individual differences in learning rates; (c) applies appropriate corrective action.	(a) learning styles; (b) strategies for training adaptation to meet individual needs.
Evaluate training sessions	(a) elicits feedback from trainees; (b) tracks training session processes against competence criteria; (c) keeps appropriate records.	(a) competency unit and associated elements; (b) performance criteria.

Report outcome	reports accurately using only observed actions and events.	(a) phase training objectives; (b) individual versus systemic weaknesses.

FCL.925 Additional requirements for instructors for the MPL

(a) Instructors conducting training for the MPL shall:

(1) have successfully completed an MPL instructor training course at an ATO; and

(2) additionally, for the basic, intermediate and advanced phases of the MPL integrated training course:

(i) be experienced in multi-pilot operations; and

(ii) have completed initial crew resource management training with a commercial air transport operator approved in accordance with the applicable air operations requirements.

(b) MPL instructors training course

(1) The MPL instructor training course shall comprise at least 14 hours of training.

Upon completion of the training course, the applicant shall undertake an assessment of instructor competencies and of knowledge of the competency-based approach to training.

(2) The assessment shall consist of a practical demonstration of flight instruction in the appropriate phase of the MPL training course. This assessment shall be conducted by an examiner qualified in accordance with Subpart K.

(3) Upon successful completion of the MPL training course, the ATO shall issue an MPL instructor qualification certificate to the applicant.

(c) In order to maintain the privileges, the instructor shall have, within the preceding 12 months, conducted within an MPL training course:

(1) 1 simulator session of at least 3 hours; or

(2) 1 air exercise of at least 1 hour comprising at least 2 take-offs and landings.

(d) If the instructor has not fulfilled the requirements of (c), before exercising the privileges to conduct flight instruction for the MPL he/she shall:

(1) receive refresher training at an ATO to reach the level of competence necessary to pass the assessment of instructor competencies; and

(2) pass the assessment of instructor competencies as set out in (b)(2).

AMC1 FCL.925 Additional requirements for instructors for the MPL

MPL INSTRUCTOR COURSE

(a) The objectives of the MPL instructors training course are to train applicants to deliver training in accordance with the features of a competency-based approach to training and assessment.

(b) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching and assessing threat and error management and CRM in the multi-crew environment.

(c) The course is intended to adapt instructors to conduct competency-based MPL training. It should cover the items specified below:

THEORETICAL KNOWLEDGE

(d) Integration of operators and organisations providing MPL training:

(1) reasons for development of the MPL;

(2) MPL training course objective;

(3) adoption of harmonised training and procedures;

(4) feedback process.

(e) The philosophy of a competency-based approach to training: principles of competency-based training.

(f) Regulatory framework, instructor qualifications and competencies:

(1) source documentation;

(2) instructor qualifications;

(3) syllabus structure.

(g) Introduction to Instructional systems design methodologies (see ICAO PANS-TRG Doc):

(1) analysis;

(2) design and production;

(3) evaluation and revision.

(h) Introduction to the MPL training scheme:

(1) training phases and content;

(2) training media;

(3) competency units, elements and performance criteria.

(i) Introduction to human performance limitations, including the principles of threat and error management and appropriate countermeasures developed in CRM:

(1) definitions;

(2) appropriate behaviours categories;

(3) assessment system.

(j) Application of the principles of threat and error management and CRM principles to training:

(1) application and practical uses;

(2) assessment methods;

(3) individual corrective actions;

(4) debriefing techniques.

(k) The purpose and conduct of assessments and evaluations:

(1) basis for continuous assessment against a defined competency standard;

(2) individual assessment;

(3) collection and analysis of data;

(4) training system evaluation.

PRACTICAL TRAINING

(l) Practical training may be conducted by interactive group classroom modules, or by the use of training devices. The objective is to enable instructors to:

(1) identify behaviours based on observable actions in the following areas:

(i) communications;

(ii) team working;

(iii) situation awareness;

(iv) workload management;

(v) problem solving and decision making.

(2) analyse the root causes of undesirable behaviours;

(3) debrief students using appropriate techniques, in particular:

(i) use of facilitative techniques;

(ii) encouragement of student self-analysis.

(4) agree corrective actions with the students;

(5) determine achievement of the required competency.

AMC2 FCL.925(d)(1) Additional requirements for instructors for the MPL

RENEWAL OF PRIVILEGES: REFRESHER TRAINING

(a) Paragraph (d) of FCL.925 determines that if the applicant has not complied with the requirements to maintain his/her privileges to conduct competency-based approach training, he or she shall receive refresher training at an ATO to reach the level of competence necessary to pass the assessment of instructor competencies. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant;

(2) the amount of time lapsed since the last time the applicant has conducted training in an MPL course. The amount of training needed to reach the desired level of competence should increase with the time lapsed. In some cases, after evaluating the instructor, and when the time lapsed is very limited, the ATO may even determine that no further refresher training is necessary.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme, which should be based on the MPL instructor course and focus on the aspects where the applicant has shown the greatest needs.

GM1 FCL.925 Additional requirements for instructors for the MPL

MPL INSTRUCTORS

The following table summarises the instructor qualifications for each phase of MPL integrated training course:

Phase of training	Qualification
Line flying under supervision according to operational requirements	Line training captain or TRI(A)
Phase 4: Advanced base training	TRI(A)
Phase 4: Advanced skill test	TRE(A)
Phase 4: Advanced	SFI(A) or TRI(A)
Phase 3: Intermediate	SFI(A) or TRI(A)
Phase 2: Basic	(a) FI(A) or IRI(A) and IR(A)/ME/MCC and 1500 hours multi-crew environment and IR(A) instructional privileges, or (b) FI(A) and MCCI(A), or (c) FI(A) and SFI(A), or (d) FI(A) and TRI(A)
Phase 1: Core flying skills	FI(A) and 500 hours, including 200 hours of instruction Instructor qualifications and privileges should be in accordance with the training items within the phase. STI for appropriate exercises conducted in an FNPT or BITD.

FCL.930 Training course

Applicants for an instructor certificate shall have completed a course of theoretical knowledge and flight instruction at an ATO. In addition to the specific elements prescribed in this Part for each category of instructor, the course shall contain the elements required in FCL.920.

FCL.935 Assessment of competence

(a) Except for the multi-crew cooperation instructor (MCCI), the synthetic training instructor (STI), the mountain rating instructor (MI) and the flight test instructor (FTI), an applicant for an instructor certificate shall pass an assessment of competence in the appropriate aircraft category to demonstrate to an examiner qualified in accordance with Subpart K the ability to instruct a student pilot to the level required for the issue of the relevant licence, rating or certificate.

(b) This assessment shall include:

(1) the demonstration of the competencies described in FCL.920, during pre- flight, post-flight and theoretical knowledge instruction;

(2) oral theoretical examinations on the ground, pre-flight and post-flight briefings and in-flight demonstrations in the appropriate aircraft class, type or FSTD;

(3) exercises adequate to evaluate the instructor's competencies.

(c) The assessment shall be performed on the same class or type of aircraft or FSTD used for the flight instruction.

(d) When an assessment of competence is required for revalidation of an instructor certificate, an applicant who fails to achieve a pass in the assessment before the expiry date of an instructor certificate shall not exercise the privileges of that certificate until the assessment has successfully been completed.

AMC1 FCL.935 Assessment of competence

GENERAL

(a) The format and application form for the assessment of competence are determined by the competent authority.

(b) When an aircraft is used for the assessment, it should meet the requirements for training aircraft.

(c) If an aircraft is used for the test or check, the examiner acts as the PIC, except in circumstances agreed upon by the examiner when another instructor is designated as PIC for the flight.

(d) During the skill test the applicant occupies the seat normally occupied by the instructor (instructors seat if in an FSTD, or pilot seat if in an aircraft), except in the case of balloons. The examiner, another instructor or, for MPA in an FFS, a real crew under instruction, functions as the 'student'. The applicant is required to explain the relevant exercises and to demonstrate their conduct to the 'student', where appropriate. Thereafter, the 'student' executes the same manoeuvres (if the 'student' is the examiner or another instructor, this can include typical mistakes of inexperienced students). The applicant is expected to correct mistakes orally or, if necessary, by intervening physically.

(e) The assessment of competence should also include additional demonstration exercises, as decided by the examiner and agreed upon with the applicant before the assessment. These additional exercises should be related to the training requirements for the applicable instructor certificate.

(f) All relevant exercises should be completed within a period of 6 months. However, all exercises should, where possible, be completed on the same day. In principle, failure in any exercise requires a retest covering all exercises, with the exception of those that may be retaken separately. The examiner may terminate the assessment at any stage if they consider that a retest is required.

AMC2 FCL.935 Assessment of competence

MCCI, STI AND MI

In the case of the MCCI, STI and MI, the instructor competencies are assessed continuously during the training course.

AMC3 FCL.935 Assessment of competence

CONTENT OF THE ASSESSMENT FOR THE FI

(a) In the case of the FI, the content of the assessment of competence should be the following:

SECTION 1 THEORETICAL KNOWLEDGE ORAL	
1.1	Air law
1.2	Aircraft general knowledge
1.3	Flight performance and planning
1.4	Human performance and limitations
1.5	Meteorology
1.6	Navigation
1.7	Operational procedures
1.8	Principles of flight
1.9	Training administration

Sections 2 and 3 selected main exercises:

SECTION 2 PRE-FLIGHT BRIEFING	
2.1	Visual presentation
2.3	Technical accuracy
2.4	Clarity of explanation
2.5	Clarity of speech
2.6	Instructional technique
2.7	Use of models and aids
2.8	Student participation
SECTION 3 FLIGHT	
3.1	Arrangement of demo
3.2	Synchronisation of speech with demo
3.3	Correction of faults

3.4	Aircraft handling
3.5	Instructional technique
3.6	General airmanship and safety
3.7	Positioning and use of airspace

SECTION 4 ME EXERCISES	
4.1	Actions following an engine failure shortly after take-off[1]
4.2	SE approach and go-around[1]
4.3	SE approach and landing[1]

[1] These exercises are to be demonstrated at the assessment of competence for FI for ME aircraft.

SECTION 5 POST-FLIGHT DE-BRIEFING	
5.1	Visual presentation
5.2	Technical accuracy
5.3	Clarity of explanation
5.4	Clarity of speech
5.5	Instructional technique
5.6	Use of models and aids
5.7	Student participation

(b) Section 1, the oral theoretical knowledge examination part of the assessment of competence, is for all FI and is subdivided into two parts:

(1) The applicant is required to give a lecture under test conditions to other 'student(s)', one of whom will be the examiner. The test lecture is to be selected from items of section 1. The amount of time for preparation of the test lecture is agreed upon beforehand with the examiner. Appropriate literature may be used by the applicant. The test lecture should not exceed 45 minutes;

(2) The applicant is tested orally by an examiner for knowledge of items of section 1 and the 'core instructor competencies: teaching and learning' content given in the instructor courses.

(c) Sections 2, 3 and 5 are for all FIs. These sections comprise exercises to demonstrate the ability to be an FI (for example instructor demonstration exercises) chosen by the examiner from the flight syllabus of the FI training courses. The applicant is required to demonstrate FI abilities, including briefing, flight instruction and de-briefing.

(d) Section 4 comprises additional instructor demonstration exercises for an FI for ME aircraft. This section, if applicable, is done in an ME aircraft, or an FFS or FNPT II simulating an ME aircraft. This section is completed in addition to sections 2, 3 and 5.

AMC4 FCL.935 Assessment of competence

CONTENT OF THE ASSESSMENT FOR THE SFI

The assessment should consist of at least 3 hours of flight instruction related to the duties of an SFI on the applicable FFS or FTD 2/3.

AMC5 FCL.935 Assessment of competence

REPORT FORMS FOR THE INSTRUCTOR CERTIFICATES

(a) Assessment of competence form for the FI, IRI and CRI certificates:

APPLICATION AND REPORT FORM FOR THE INSTRUCTOR ASSESSMENT OF COMPETENCE			
1	**Applicants personal particulars:**		
Applicant's last name(s):		First name(s):	
Date of birth:		Tel (home):	Tel (work):
Address:		Country:	
2	**Licence details**		
Licence type:		Number:	
Class ratings included in the licence:		Exp. Date:	
Type ratings included in the licence:	1.		
	2.		
	3.		
	4.		
	5.		
Other ratings included in the licence:	1.		
	2.		
	3.		
	4.		
	5.		
3	**Pre-course flying experience**		

Total flying hours	PIC SEP or TMG hours	SEP preceding 6 months	Instrument flight instruction	Cross-country hours

4	**Pre-entry flight test**				
I recommend ....for the FI course.					
Name of ATO:			Date of flight test:		
Name(s) of FI conducting the test (capital letters):					
Licence number:					
Signature:					
5	**Declaration by the applicant**				
I have received a course of training in accordance with the syllabus for the: *(tick as applicable)*					
FI certificate FI(A)/(H)/(As)		IRI certificate IRI(A)/(H)/(As)		CRI certificate CRI(A)	
Applicant's name(s): (capital letters)			Signature:		
6	**Declaration by the CFI**				
I certify that .... has satisfactorily completed an approved course of training for the					
FI certificate FI(A)/(H)/(As)		IRI certificate IRI(A)/(H)/(As)		CRI certificate CRI(A)	
in accordance with the relevant syllabus.					
Flying hours during the course:					
Aircraft or FSTDs used :					
Name(s) of CFI:					
Signature:					
Name of ATO:					
7	**Flight instructor examiner's certificate**				
I have tested the applicant according to to Part-FCL					
A. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT (in case of partial pass):					

Theoretical oral examination:		Skill test:	
Passed	***Failed***	***Passed***	***Failed***

	I recommend further flight or ground training with an instructor before re-test
	I do not consider further flight or theoretical instruction necessary before re-test *(tick as applicable)*
B. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT:	
	FI certificate
	IRI certificate
	CRI certificate *(tick as applicable)*
Name(s) of FIE (capital letters):	
Signature:	
Licence number:	Date:

(b) Report form for the FI for sailplanes

APPLICATION AND REPORT FORM FOR THE FI(S) ASSESSMENT OF COMPETENCE				
1	**Applicants personal particulars:**			
Applicant's last name(s):		First name(s):		
Date of birth:		Tel (home):	Tel (work):	
Address:		Country:		
2	**Licence Details**			
Licence type:		Number:		
TMG extension:				
3	**Pre-course flying experience**			
Total hours	PIC hours	Sailplane (PIC hours and take-offs)	TMG (PIC hours and take-offs)	
4	**Pre-entry flight test**			
I recommend ....for the FI course.				

Name of ATO:			Date of flight test:		
Name(s) of FI conducting the test (capital letters):					
Licence number:					
Signature:					
5	**Declaration by the applicant**				
I have received a course of training in accordance with the syllabus for the:					
FI certificate FI(S)					
Applicant's name(s): (capital letters)			Signature:		
6	**Declaration by the chief flight instructor**				
I certify that .... has satisfactorily completed a course of training for the					
FI certificate FI(S)					
In accordance with the relevant syllabus.					
Flying hours during the course:			Take-offs during the course:		
Sailplanes, powered sailplanes or TMGs used :					
Name(s) of CFI:					
Signature:					
Name of ATO:					
7	**Flight instructor examiner's certificate**				
I have tested the applicant according to Part-FCL					
A. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT (in case of partial pass):					
Theoretical oral examination:			Skill test:		
Passed		***Failed***	***Passed***	***Failed***	
	I recommend further flight or ground training with an FI before re-test				
	I do not consider further flight or theoretical instruction necessary before re-test *(tick as applicable)*				
B. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT:					
	FI certificate				
	Date:				
Name(s) of FIE (capital letters):					

Signature:	
Licence number:	Date:

(c) Report form for the FI for balloons:

APPLICATION AND REPORT FORM FOR THE FI(B) ASSESSMENT OF COMPETENCE				
1	**Applicants personal particulars:**			
Applicant's last name(s):		First name(s):		
Date of birth:		Tel (home):	Tel (work):	
Address:		Country:		
2	**Licence Details**			
Licence type:		Number:		
Class extensions:	1.	Groups:		
	2.	Groups:		
	3.	Groups:		
3	**Pre-course flying experience**			
Total flying hours in different groups	PIC hours	Hot-air balloon	Gas balloon	Hot-air airship
4	**Pre-entry flight test**			
I recommend ....for the FI course				
Name of ATO:		Date of flight test:		
Name(s) of FI conducting the test (capital letters):				
Licence number:				
Signature:				
5	**Declaration by the applicant**			
I have received a course of training in accordance with the syllabus for the:				
FI certificate FI(B)				

Applicant's name(s): (capital letters)				Signature:	
6	**Declaration by the chief flight instructor**				
I certify that .... has satisfactorily completed a course of training for the					
FI certificate FI(B)					
in accordance with the relevant syllabus.					
Flying hours during the course:			Take-offs during the course:		
Balloons, hot-air airships used:					
Name(s) of CFI:					
Signature:					
Name of ATO:					
7	**Flight Instructor examiner's certificate**				
I have tested the applicant according to Part-FCL					
A – FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT in case of partial pass:					
Theoretical oral examination:			Skill test:		
Passed		***Failed***	***Passed***		***Failed***
	I recommend further flight or ground training with an FI before re-test				
	I do not consider further flight or theoretical instruction necessary before re-test *(tick as applicable)*				
B – FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT:					
	FI certificate				
Name(s) of FIE (capital letters):					
Signature:					
Licence number:				Date:	

FCL.940 Validity of instructor certificates

With the exception of the MI, and without prejudice to FCL.900(b)(1), instructor certificates shall be valid for a period of 3 years.

FCL.945 Obligations for instructors

Upon completion of the training flight for the revalidation of an SEP or TMG class rating in accordance with FCL.740.A (b)(1) and only in the event of fulfilment of all the other revalidation criteria required by FCL.740.A (b)(1) the instructor shall endorse the applicant's licence with the new expiry date of the rating or certificate, if specifically authorised for that purpose by the competent authority responsible for the applicant's licence.

SECTION 2 - Specific requirements for the flight instructor — FI

FCL.905.FI FI — Privileges and conditions

The privileges of an FI are to conduct flight instruction for the issue, revalidation or renewal of:

(a) a PPL, SPL, BPL and LAPL in the appropriate aircraft category;

(b) class and type ratings for single-pilot, single-engine aircraft, except for single-pilot high performance complex aeroplanes; class and group extensions for balloons and class extensions for sailplanes;

(c) type ratings for single or multi-pilot airship;

(d) a CPL in the appropriate aircraft category, provided that the FI has completed at least 500 hours of flight time as a pilot on that aircraft category, including at least 200 hours of flight instruction;

(e) the night rating, provided that the FI:

(1) is qualified to fly at night in the appropriate aircraft category;

(2) has demonstrated the ability to instruct at night to an FI qualified in accordance with (i) below; and

(3) complies with the night experience requirement of FCL.060(b)(2);

(f) a towing, aerobatic or, in the case of an FI(S), a cloud flying rating, provided that such privileges are held and the FI has demonstrated the ability to instruct for that rating to an FI qualified in accordance with point (i);

(g) an EIR or an IR in the appropriate aircraft category, provided that the FI has:

(1) at least 200 hours of flight time under IFR, of which up to 50 hours may be instrument ground time in an FFS, an FTD 2/3 or FNPT II;

(2) completed as a student pilot the IRI training course and has passed an assessment of competence for the IRI certificate; and

(3) in addition:

(i) for multi-engine aeroplanes, met the requirements for a CRI for multi- engine aeroplanes;

(ii) for multi-engine helicopters, met the requirements for the issue of a TRI certificate;

(h) single-pilot multi-engine class or type ratings, except for single-pilot high performance complex aeroplanes, provided that the FI meets:

(1) in the case of aeroplanes, the prerequisites for the CRI training course established in FCL.915.CRI(a) and the requirements of FCL.930.CRI and FCL.935;

(2) in the case of helicopters, the requirements established in FCL.910.TRI(c)(1) and the prerequisites for the TRI(H) training course established in FCL.915.TRI(d)(2);

(i) an FI, IRI, CRI, STI or MI certificate provided that the FI has:

(1) completed at least:

(i) in the case of an FI(S), at least 50 hours or 150 launches of flight instruction on sailplanes;

(ii) in the case of an FI(B), at least 50 hours or 50 take-offs of flight instruction on balloons;

(iii) in all other cases, 500 hours of flight instruction in the appropriate aircraft category;

(2) passed an assessment of competence in accordance with FCL.935 in the appropriate aircraft category to demonstrate to a Flight Instructor Examiner (FIE) the ability to instruct for the FI certificate;

(j) an MPL, provided that the FI:

(1) for the core flying phase of the training, has completed at least 500 hours of flight time as a pilot on aeroplanes, including at least 200 hours of flight instruction;

(2) for the basic phase of the training:

(i) holds a multi-engine aeroplane IR and the privilege to instruct for an IR; and

(ii) has at least 1 500 hours of flight time in multi-crew operations;

(3) in the case of an FI already qualified to instruct on ATP(A) or CPL(A)/IR integrated courses, the requirement of (2)(ii) may be replaced by the completion of a structured course of training consisting of:

(i) MCC qualification;

(ii) observing 5 sessions of flight instruction in Phase 3 of an MPL course;

(iii) observing 5 sessions of flight instruction in Phase 4 of an MPL course;

(iv) observing 5 operator recurrent line oriented flight training sessions;

(v) the content of the MCCI instructor course.

In this case, the FI shall conduct its first 5 instructor sessions under the supervision of a TRI(A), MCCI(A) or SFI(A) qualified for MPL flight instruction.

FCL.910.FI FI — Restricted privileges

(a) An FI shall have his/her privileges limited to conducting flight instruction under the supervision of an FI for the same category of aircraft nominated by the ATO for this purpose, in the following cases:

(1) for the issue of the PPL, SPL, BPL and LAPL;

(2) in all integrated courses at PPL level, in case of aeroplanes and helicopters;

(3) for class and type ratings for single-pilot, single-engine aircraft, except for single-pilot high performance complex aeroplanes, class and group extensions in the case of balloons and class extensions in the case of sailplanes;

(4) for the night, towing or aerobatic ratings.

(b) While conducting training under supervision, in accordance with (a), the FI shall not have the privilege to authorise student pilots to conduct first solo flights and first solo cross-country flights.

(c) The limitations in (a) and (b) shall be removed from the FI certificate when the FI has completed at least:

(1) for the FI(A), 100 hours of flight instruction in aeroplanes or TMGs and, in addition has supervised at least 25 student solo flights;

(2) for the FI(H) 100 hours of flight instruction in helicopters and, in addition has supervised at least 25 student solo flight air exercises;

(3) for the FI(As), FI(S) and FI(B), 15 hours or 50 take-offs of flight instruction covering the full training syllabus for the issue of a PPL(As), SPL or BPL in the appropriate aircraft category.

FCL.915.FI FI — Prerequisites

An applicant for an FI certificate shall:

(a) in the case of the FI(A) and FI(H):

(1) have received at least 10 hours of instrument flight instruction on the appropriate aircraft category, of which not more than 5 hours may be instrument ground time in an FSTD;

(2) have completed 20 hours of VFR cross-country flight on the appropriate aircraft category as PIC; and

(b) additionally, for the FI(A):

(1) hold at least a CPL(A); or

(2) hold at least a PPL(A) and have:

(i) met the requirements for CPL theoretical knowledge, except for an FI(A) providing training for the LAPL(A) only; and

(ii) completed at least 200 hours of flight time on aeroplanes or TMGs, of which 150 hours as PIC;

(3) have completed at least 30 hours on single-engine piston powered aeroplanes of which at least 5 hours shall have been completed during the 6 months preceding the pre-entry flight test set out in FCL.930.FI(a);

(4) have completed a VFR cross-country flight as PIC, including a flight of at least 540 km (300 NM) in the course of which full stop landings at 2 different aerodromes shall be made;

(c) additionally, for the FI(H), have completed 250 hours total flight time as pilot on helicopters of which:

(1) at least 100 hours shall be as PIC, if the applicant holds at least a CPL(H); or

(2) at least 200 hours as PIC, if the applicant holds at least a PPL(H) and has met the requirements for CPL theoretical knowledge;

(d) for an FI(As), have completed 500 hours of flight time on airships as PIC, of which 400 hours shall be as PIC holding a CPL(As);

(e) for an FI(S), have completed 100 hours of flight time and 200 launches as PIC on sailplanes. Additionally, where the applicant wishes to give flight instruction on TMGs, he/she shall have completed 30 hours of flight time as PIC on TMGs and an additional assessment of competence on a TMG in accordance with FCL.935 with an FI qualified in accordance with FCL.905.FI(i);

(f) for an FI(B), have completed 75 hours of balloon flight time as PIC, of which at least 15 hours have to be in the class for which flight instruction will be given.

FCL.930.FI FI — Training course

(a) Applicants for the FI certificate shall have passed a specific pre-entry flight test with an FI qualified in accordance with FCL.905.FI(i) within the 6 months preceding the start of the course, to assess their ability to undertake the course. This pre-entry flight test shall be based on the proficiency check for class and type ratings as set out in Appendix 9 to this Part.

(b) The FI training course shall include:

(1) 25 hours of teaching and learning;

(2)

(i) in the case of an FI(A), (H) and (As), at least 100 hours of theoretical knowledge instruction, including progress tests;

(ii) in the case of an FI(B) or FI(S), at least 30 hours of theoretical knowledge instruction, including progress tests;

(3)

(i) in the case of an FI(A) and (H), at least 30 hours of flight instruction, of which 25 hours shall be dual flight instruction, of which 5 hours may be conducted in an FFS, an FNPT I or II or an FTD 2/3;

(ii) in the case of an FI(As), at least 20 hours of flight instruction, of which 15 hours shall be dual flight instruction;

(iii) in the case of an FI(S), at least 6 hours or 20 take-offs of flight instruction;

(iv) in the case of an FI(S) providing training on TMGs, at least 6 hours of dual flight instruction on TMGs;

(v) in the case of an FI(B), at least 3 hours of flight instruction, including 3 take-offs.

(4) When applying for an FI certificate in another category of aircraft, pilots holding or having held an FI(A), (H) or (As) shall be credited with 55 hours towards the requirement in point (b)(2)(i) or with 18 hours towards the requirements in point (b)(2)(ii).

AMC1 FCL.930.FI FI — Training course

FI(A), FI(H) AND FI(AS) TRAINING COURSE

GENERAL

(a) The aim of the FI training course is to train aircraft licence holders to the level of competence defined in FCL.920.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the FI task including at least the following:

(1) refresh the technical knowledge of the student instructor;

(2) train the student instructor to teach the ground subjects and air exercises;

(3) ensure that the student instructor's flying is of a sufficiently high standard;

(4) teach the student instructor the principles of basic instruction and to apply them at the PPL level.

FLIGHT INSTRUCTION

(c) The remaining 5 hours in FCL.930.FI (b)(3) may be mutual flying (that is, two applicants flying together to practice flight demonstrations).

(d) The skill test is additional to the course training time.

CONTENT

(e) The training course consists of two parts:

(1) Part 1, theoretical knowledge, including the teaching and learning instruction that should comply with AMC1 FCL.920;

(2) Part 2, flight instruction.

Part 1

TEACHING AND LEARNING

(a) The course should include at least 125 hours of theoretical knowledge instruction, including at least 25 hours teaching and learning instruction.

CONTENT OF THE TEACHING AND LEARNING INSTRUCTIONS (INSTRUCTIONAL TECHNIQUES):

(b) The learning process:

(1) motivation;

(2) perception and understanding;

(3) memory and its application;

(4) habits and transfer;

(5) obstacles to learning;

(6) incentives to learning;

(7) learning methods;

(8) rates of learning.

(c) The teaching process:

(1) elements of effective teaching;

(2) planning of instructional activity;

(3) teaching methods;

(4) teaching from the ‘known’ to the ‘unknown’;

(5) use of ‘lesson plans’.

(d) Training philosophies:

(1) value of a structured (approved) course of training;

(2) importance of a planned syllabus;

(3) integration of theoretical knowledge and flight instruction;

(e) Techniques of applied instruction:

(1) theoretical knowledge: classroom instruction techniques:

(i) use of training aids;

(ii) group lectures;

(iii) individual briefings;

(iv) student participation or discussion.

(2) flight: airborne instruction techniques:

(i) the flight or cockpit environment;

(ii) techniques of applied instruction;

(iii) post-flight and in-flight judgement and decision making.

(f) Student evaluation and testing:

(1) assessment of student performance:

(i) the function of progress tests;

(ii) recall of knowledge;

(iii) translation of knowledge into understanding;

(iv) development of understanding into actions;

(v) the need to evaluate rate of progress.

(2) analysis of student errors:

(i) establish the reason for errors;

(ii) tackle major faults first, minor faults second;

(iii) avoidance of over criticism;

(iv) the need for clear concise communication.

(g) Training programme development:

(1) lesson planning;

(2) preparation;

(3) explanation and demonstration;

(4) student participation and practice;

(5) evaluation.

(h) Human performance and limitations relevant to flight instruction:

(1) physiological factors:

(i) psychological factors;

(ii) human information processing;

(iii) behavioural attitudes;

(iv) development of judgement and decision making.

(2) threat and error management.

(i) Specific hazards involved in simulating systems failures and malfunctions in the aircraft during flight:

(i) importance of 'touch drills';

(ii) situational awareness;

(iii) adherence to correct procedures.

(j) Training administration:

(1) flight or theoretical knowledge instruction records;

(2) pilot's personal flying logbook;

(3) the flight or ground curriculum;

(4) study material;

(5) official forms;

(6) flight manual or equivalent document (for example owner's manual or pilot's operating handbook);

(7) flight authorisation papers;

(8) aircraft documents;

(9) the private pilot's licence regulations.

A. Aeroplanes

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(A) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include information on how the flight will be conducted, who is to fly the aeroplane and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

(1) the aim;

(2) principles of flight (briefest reference only);

(3) the air exercise(s) (what, and how and by whom);

(4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(A) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(A).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) If the privileges of the FI(A) certificate are to include instruction for night flying, exercises 19 and 20 of the flight instruction syllabus should be undertaken at night in addition to by day either as part of the course or subsequent to certification issue.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

LONG BRIEFINGS AND AIR EXERCISES

Note: though exercise 11b is not required for the PPL(A) course, it is a requirement for the FI course.

EXERCISE 1: FAMILIARISATION WITH tHE AEROPLANE

(a) Long briefing objectives:

(1) introduction to the aeroplane;

(2) explanation of the cockpit layout;

(3) aeroplane and engine systems;

(4) checklists, drills and controls;

(5) propeller safety;

(i) precautions general;

(ii) precautions before and during hand turning;

(iii) hand swinging technique for starting (if applicable to type).

(6) differences when occupying the instructor’s seat;

(7) emergency drills:

(i) action if fire in the air and on the ground: engine, cock or cabin and electrical fire;

(ii) system failure as applicable to type;

(iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

(1) flight authorisation and aeroplane acceptance, including technical log (if applicable) and certificate of maintenance;

(2) equipment required for flight (maps, etc.);

(3) external checks;

(4) internal checks;

(5) student comfort, harness, seat or rudder pedal adjustment;

(6) starting and warming up checks;

(7) power checks;

(8) running down, system checks and switching off the engine;

(9) leaving the aeroplane, parking, security and picketing;

(10) completion of authorisation sheet and aeroplane serviceability documents.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of primary flying controls: when laterally level and banked;

(2) further effect of ailerons and rudder;

(3) effect of inertia;

(4) effect of air speed;

(5) effect of slipstream;

(6) effect of power;

(7) effect of trimming controls;

(8) effect of flaps;

(9) operation of mixture control;

(10) operation of carburettor heat control;

(11) operation of cabin heat or ventilation systems;

(b) Air exercise:

(1) primary effects of flying controls: when laterally level and banked;

(2) further effects of ailerons and rudder;

(3) effect of air speed;

(4) effect of slipstream;

(5) effect of power;

(6) effect of trimming controls;

(7) effect of flaps;

(8) operation of mixture control;

(9) operation of carburettor heat control;

(10) operation of cabin heat or ventilation systems;

(11) effect of other controls as applicable.

EXERCISE 5: TAXIING

(a) Long briefing objectives:

(1) pre-taxiing checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) control of direction and turning (including manoeuvring in confined spaces);

(5) parking area procedures and precautions;

(6) effect of wind and use of flying controls;

(7) effect of ground surface;

(8) freedom of Rudder movement;

(9) marshalling signals;

(10) instrument checks;

(11) ATC procedures;

(12) emergencies: steering failure and brake failure.

(b) Air exercise:

(1) pre-taxiing checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) control of direction and turning;

(5) turning in confined spaces;

(6) parking area procedures and precautions;

(7) effect of wind and use of flying control;

(8) effect of ground surface;

(9) freedom of Rudder movement;

(10) marshalling signals;

(11) instrument checks;

(12) ATC procedures;

(13) emergencies: steering failure and brake failure.

EXERCISE 6: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) the forces;

(2) longitudinal stability and control in pitch;

(3) relationship of CG to control in pitch;

(4) lateral and directional stability (control of lateral level and balance);

(5) attitude and balance control;

(6) trimming;

(7) power settings and air speeds;

(8) drag and power curves;

(9) range and endurance.

(b) Air exercise:

(1) at normal cruising power;

(2) attaining and maintaining straight and level flight;

(3) demonstration of inherent stability;

(4) control in pitch, including use of elevator trim control;

(5) lateral level, direction and balance, use of rudder trim controls as applicable at selected air speeds (use of power):

(i) effect of drag and use of power (two air speeds for one power setting);

(ii) straight and level in different aeroplane configurations (flaps and landing gear);

(iii) use of instruments to achieve precision flight.

EXERCISE 7: CLIMBING

(a) Long briefing objectives:

(1) the forces;

(2) relationship between power or air speed and rate of climb (power curves maximum rate of climb (v_y));

(3) effect of mass;

(4) effect of flaps;

(5) engine considerations;

(6) effect of density altitude;

(7) the cruise climb;

(8) maximum angle of climb (v_x).

(b) Air exercise:

(1) entry and maintaining the normal maximum rate climb;

(2) levelling off;

(3) levelling off at selected altitudes;

(4) climbing with flaps down;

(5) recovery to normal climb;

(6) en-route climb (cruise climb);

(7) maximum angle of climb;

(8) use of instruments to achieve precision flight.

EXERCISE 8: DESCENDING

(a) Long briefing objectives:

(1) the forces;

(2) glide descent: angle, air speed and rate of descent;

(3) effect of flaps;

(4) effect of wind;

(5) effect of mass;

(6) engine considerations;

(7) power assisted descent: power or air speed and rate of descent;

(8) cruise descent;

(9) sideslip.

(b) Air exercise:

(1) entry and maintaining the glide;

(2) levelling off;

(3) levelling off at selected altitudes;

(4) descending with flaps down;

(5) powered descent: cruise descent (including effect of power and air speed);

(6) side-slipping (on suitable types);

(7) use of instrument to achieve precision flight.

EXERCISE 9: TURNING

(a) Long briefing objectives:

(1) the forces;

(2) use of controls;

(3) use of power;

(4) maintenance of attitude and balance;

(5) medium level turns;

(6) climbing and descending turns;

(7) slipping turns;

(8) turning onto selected headings: use of gyro heading indicator and magnetic compass.

(b) Air exercise:

(1) entry and maintaining medium level turns;

(2) resuming straight flight;

(3) faults in the turn (incorrect pitch, bank and balance);

(4) climbing turns;

(5) descending turns;

(6) slipping turns (on suitable types);

(7) turns to selected headings: use of gyro heading indicator and magnetic compass

(8) use of instruments to achieve precision flight;

Note: stall or spin awareness and avoidance training consists of exercises 10a, 10b and 11a.

EXERCISE 10a: SLOW FLIGHT

(a) Long briefing objectives:

(1) aeroplane handling characteristics during slow flight at:

(i) v_{s1} & v_{so} + 10 knots;

(ii) v_{s1} & v_{so} + 5 knots.

(2) slow flight during instructor induced distractions;

(2) effect of overshooting in configurations where application of engine power causes a strong ‘nose-up’ trim change.

(b) Air exercise:

(1) safety checks;

(2) introduction to slow flight;

(3) controlled slow flight in the clean configuration at:

(i) v_{s1} + 10 knots and with flaps down;

(ii) v_{so} + 10 knots;

(iii) straight and level flight;

(iv) level turns;

(v) climbing and descending;

(vi) climbing and descending turns.

(4) controlled slow flight in the clean configuration at:

(i) v_{s1} + 5 knots and with flaps down;

(ii) v_{so} + 5 knots;

(iii) straight and level flight;

(iv) level turns;

(v) climbing and descending;

(vi) climbing and descending turns;

(vii) descending 'unbalanced' turns at low air speed: the need to maintain balanced flight.

(5) 'instructor induced distractions' during flight at low air speed: the need to maintain balanced flight and a safe air speed;

(6) effect of going around in configurations where application of engine power causes a strong 'nose up' trim change.

EXERCISE 10b: STALLING

(a) Long briefing objectives:

(1) characteristics of the stall;

(2) angle of attack;

(3) effectiveness of the controls at the stall;

(4) factors affecting the stalling speed:

(i) effect of flaps, slats and slots;

(ii) effect of power, mass, CG and load factor.

(5) effects of unbalance at the stall;

(6) symptoms of the stall;

(7) stall recognition and recovery;

(8) stalling and recovery:

(i) without power;

(ii) with power on;

(iii) with flaps down;

(iv) maximum power climb (straight and turning flight to the point of stall with uncompensated yaw);

(v) stalling and recovery during manoeuvres involving more than 1 G (accelerated stalls, including secondary stalls and recoveries);

(vi) recovering from incipient stalls in the landing and other configurations and conditions;

(vii) recovering at the incipient stage during change of configuration;

(viii) stalling and recovery at the incipient stage with 'instructor induced' distractions.

Note: consideration is to be given to manoeuvre limitations and references to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance limitations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are also covered in the next exercise spinning.

(b) Air exercise:

(1) safety checks;

(2) symptoms of the stall;

(3) stall recognition and recovery:

(i) without power;

(ii) with power on;

(iii) recovery when a wing drops at the stall;

(iv) stalling with power 'on' and recovery;

(v) stalling with flap 'down' and recovery;

(vi) maximum power climb (straight and turning flight) to the point of stall with uncompensated yaw: effect of unbalance at the stall when climbing power is being used;

(vii) stalling and recovery during manoeuvres involving more than 1 G (accelerated stalls, including secondary stalls and recoveries);

(viii)recoveries from incipient stalls in the landing and other configurations and conditions;

(ix) recoveries at the incipient stage during change of configuration;

(x) instructor induced distractions during stalling.

Note: consideration of manoeuvre limitations and the need to refer to the aeroplane manual and weight (mass) and balance calculations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are to be covered in the next exercise: spinning.

EXERCISE 11a: SPIN RECOVERY AT THE INCIPIENT STAGE

(a) Long briefing objectives:

(1) causes, stages, autorotation and characteristics of the spin;

(2) recognition and recovery at the incipient stage: entered from various flight attitudes;

(3) aeroplane limitations.

(b) Air exercise:

(1) aeroplane limitations;

(2) safety checks;

(3) recognition at the incipient stage of a spin;

(4) recoveries from incipient spins entered from various attitudes with the aeroplane in the clean configuration, including instructor induced distractions.

EXERCISE 11b: SPIN RECOVERY AT THE DEVELOPED STAGE

(a) Long briefing objectives:

(1) spin entry;

(2) recognition and identification of spin direction;

(3) spin recovery;

(4) use of controls;

(5) effects of power or flaps (flap restriction applicable to type);

(6) effect of the CG upon spinning characteristics;

(7) spinning from various flight attitudes;

(8) aeroplane limitation;

(9) safety checks.

(b) Air exercise:

(1) aeroplane limitations;

(2) safety checks;

(3) spin entry;

(4) recognition and identification of the spin direction;

(5) spin recovery (reference to flight manual);

(6) use of controls;

(7) effects of power or flaps (restrictions applicable to aeroplane type);

(8) spinning and recovery from various flight attitudes.

EXERCISE 12: TAKE-OFF AND CLIMB TO DOWNWIND POSITION

(a) Long briefing objectives:

(1) handling: factors affecting the length of take-off run and initial climb;

(2) correct lift off speed, use of elevators (safeguarding the nose wheel), rudder and power;

(3) effect of wind (including crosswind component);

(4) effect of flaps (including the decision to use and the amount permitted);

(5) effect of ground surface and gradient upon the take-off run;

(6) effect of mass, altitude and temperature on take-off and climb performance;

(7) pre take-off checks;

(8) ATC procedure before take-off;

(9) drills, during and after take-off;

(10) noise abatement procedures;

(11) tail wheel considerations (as applicable);

(12) short or soft field take-off considerations or procedures;

(13) emergencies:

(i) aborted take-off;

(ii) engine failure after take-off.

(14) ATC procedures.

(b) Air exercise:

(1) take-off and climb to downwind position;

(2) pre take-off checks;

(3) into wind take-off;

(4) safeguarding the nose wheel;

(5) crosswind take-off;

(6) drills during and after take-off;

(7) short take-off and soft field procedure or techniques (including performance calculations);

(8) noise abatement procedures.

EXERCISE 13: CIRCUIT, APPROACH AND LANDING

(a) Long briefing objectives:

(1) downwind leg, base leg and approach: position and drills;

(2) factors affecting the final approach and the landing run;

(3) effect of mass;

(4) effects of altitude and temperature;

(5) effect of wind;

(6) effect of flap;

(7) landing;

(8) effect of ground surface and gradient upon the landing run;

(9) types of approach and landing:

(i) powered;

(ii) crosswind;

(iii) flapless (at an appropriate stage of the course);

(iv) glide;

(v) short field;

(vi) soft field.

(10) tail wheel aeroplane considerations (as applicable);

(11) missed approach;

(12) engine handling;

(13) wake turbulence awareness;

(14) windshear awareness;

(15) ATC procedures;

(16) mislanding and go-around;

(17) special emphasis on look-out.

(b) Air exercise:

(1) circuit approach and landing;

(2) circuit procedures: downwind and base leg;

(3) powered approach and landing;

(4) safeguarding the nose wheel;

(5) effect of wind on approach and touchdown speeds and use of flaps;

(6) crosswind approach and landing;

(7) glide approach and landing;

(8) flapless approach and landing (short and soft field);

(9) short field and soft field procedures;

(10) wheel landing (tail wheel aircraft);

(11) missed approach and go-around;

(12) mislanding and go-around;

(13) noise abatement procedures.

EXERCISE 14: FIRST SOLO AND CONSOLIDATION

Note: a summary of points to be covered before sending the student on first solo.

(a) Long briefing objectives:

During the flights immediately following the solo circuit consolidation period the following should be covered:

(1) procedures for leaving and rejoining the circuit;

(2) local area (restrictions, controlled airspace, etc.);

(3) compass turns;

(4) QDM meaning and use.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 15: ADVANCED TURNING

(a) Long briefing objectives:

(1) the forces;

(2) use of power;

(3) effect of load factor:

(i) structural considerations;

(ii) increased stalling speed.

(4) physiological effects;

(5) rate and radius of turn;

(6) steep, level, descending and climbing turns;

(7) stalling in the turn and how to avoid it;

(8) spinning from the turn: recovery at the incipient stage;

(9) spiral dive;

(10) unusual attitudes and recoveries.

Note: considerations are to be given to manoeuvre limitations and reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance, and any other restrictions for practice entries to the spin.

(b) Air exercise:

(1) level, descending and climbing steep turns;

(2) stalling in the turn;

(3) spiral dive;

(4) spinning from the turn;

(5) recovery from unusual attitudes;

(6) maximum rate turns.

EXERCISE 16: FORCED LANDING WITHOUT POWER

(a) Long briefing objectives:

(1) selection of forced landing areas;

(2) provision for change of plan;

(3) gliding distance: consideration;

(4) planning the descent;

(5) key positions;

(6) engine failure checks;

(7) use of radio: R/T 'distress' procedure;

(8) base leg;

(9) final approach;

(10) go-around;

(11) landing considerations;

(12) actions after landing: aeroplane security;

(13) causes of engine failure.

(b) Air exercise:

(1) forced landing procedures;

(2) selection of landing area:

(i) provision for change of plan;

(ii) gliding distance considerations.

(3) planning the descent;

(4) key positions;

(5) engine failure checks;

(6) engine cooling precautions;

(7) use of radio;

(8) base leg;

(9) final approach;

(10) landing;

(11) actions after landing: when the exercise is conducted at an aerodrome;

(12) aeroplane security.

EXERCISE 17: PRECAUTIONARY LANDING

(a) Long briefing objectives:

(1) occasions when necessary (in-flight conditions);

(2) landing area selection and communication (R/T procedure);

(3) overhead inspection;

(4) simulated approach;

(5) climb away;

(6) landing area selection:

(i) normal aerodrome;

(ii) disused aerodrome;

(iii) ordinary field;

(7) circuit and approach;

(8) actions after landing; aeroplane security.

(b) Air exercise:

(1) occasions when necessary (in-flight conditions):

(2) landing area selection

(3) overhead inspection

(4) simulated approach

(5) climb away

(6) landing area selection:

(i) normal aerodrome;

(ii) disused aerodrome;

(iii) ordinary field;

(7) circuit and approach;

(8) actions after landing; aeroplane security;

EXERCISE 18a: NAVIGATION

(a) Long briefing objectives:

(1) flight planning;

(i) weather forecast and actual(s);

(ii) map selection, orientation, preparation and use:

(A) choice of route;

(B) regulated or controlled airspace;

(C) danger, prohibited and restricted areas;

(D) safety altitude.

(iii) calculations:

(A) magnetic heading(s) and time(s) en-route;

(B) fuel consumption;

(C) mass and balance;

(D) mass and performance.

(iv) flight information:

(A) NOTAMs etc.;

(B) noting of required radio frequencies;

(C) selection of alternate aerodrome(s).

(v) aeroplane documentation.

(vi) notification of the flight:

(A) pre-flight administration procedures;

(B) flight plan form (where appropriate).

(2) departure;

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) setting heading procedures;

(C) noting of ETA(s).

(iii) en-route map reading: identification of ground features;

(iv) maintenance of altitudes and headings;

(v) revisions to ETA and heading, wind effect, drift angle and groundspeed checks;

(vi) log keeping;

(vii) use of radio (including VDF if applicable);

(viii) minimum weather conditions for continuance of flight;

(ix) ‘in-flight’ decisions;

(x) diversion procedures;

(xi) operations in regulated or controlled airspace;

(xii) procedures for entry, transit and departure;

(xiii) navigation at minimum level;

(xiv) uncertainty of position procedure, including R/T procedure;

(xv) lost procedure;

(xvi) use of radio navaids.

(3) arrival procedures and aerodrome circuit joining procedures:

(i) ATC liaison, R/T procedure, etc.;

(ii) altimeter setting,

(iii) entering the traffic pattern (controlled or uncontrolled aerodromes);

(iv) circuit procedures;

(v) parking procedures;

(vi) security of aircraft;

(vii) refuelling;

(viii) booking in.

(b) Air exercise:

(1) flight planning:

(i) weather forecast and actual(s);

(ii) map selection and preparation:

(A) choice of route;

(B) regulated or controlled airspace;

(C) danger, prohibited and restricted areas;

(D) safety altitude.

(iii) calculations:

(A) magnetic heading(s) and time(s) en-route;

(B) fuel consumption;

(C) mass and balance;

(D) mass and performance.

(iv) flight information:

(A) NOTAMs etc.;

(B) noting of required radio frequencies;

(C) selection of alternate aerodromes.

(v) aircraft documentation;

(vi) notification of the flight:

(A) flight clearance procedures (as applicable);

(B) flight plans.

(2) aerodrome departure;

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) en-route:

(C) noting of ETA(s).

(iii) wind effect, drift angle and ground speed checks;

(iv) maintenance of altitudes and headings;

(v) revisions to ETA and heading;

(vi) log keeping;

(vii) use of radio (including VDF if applicable);

(viii) minimum weather conditions for continuance of flight;

(ix) ‘in-flight’ decisions;

(x) diversion procedure;

(xi) operations in regulated or controlled airspace;

(xii) procedures for entry, transit and departure;

(xiii) uncertainty of position procedure;

(xiv) lost procedure;

(xv) use of radio navaids.

(3) arrival procedures and aerodrome joining procedures:

(i) ATC liaison, R/T procedure etc.;

(ii) altimeter setting,

(iii) entering the traffic pattern;

(iv) circuit procedures;

(v) parking procedures

(vi) security of aircraft;

(vii) refuelling;

(viii) booking in.

EXERCISE 18b: NAVIGATION AT LOWER LEVELS AND IN REDUCED VISIBILITY

(a) Long briefing objectives:

(1) general considerations:

(i) planning requirements before flight in entry or exit lanes;

(ii) ATC rules, pilot qualifications and aircraft equipment;

(iii) entry or exit lanes and areas where specific local rules apply.

(2) low level familiarisation:

(i) actions before descending;

(ii) visual impressions and height keeping at low altitude;

(iii) effects of speed and inertia during turns;

(iv) effects of wind and turbulence;

(3) low level operation:

(i) weather considerations;

(ii) low cloud and good visibility;

(iii) low cloud and poor visibility;

(iv) avoidance of moderate to heavy rain showers;

(v) effects of precipitation;

(vi) joining a circuit;

(vii) bad weather circuit, approach and landing.

(b) Air exercise:

(1) general considerations: entry or exit lanes and areas where specific local rules apply;

(2) low level familiarisation:

(i) actions before descending;

(ii) visual impressions and height keeping at low altitude;

(iii) effects of speed and inertia during turns;

(iv) effects of wind and turbulence;

(v) hazards of operating at low levels;

(3) low level operation:

(i) weather considerations;

(ii) low cloud and good visibility;

(iii) low cloud and poor visibility;

(iv) avoidance of moderate to heavy rain showers;

(v) effects of precipitation (forward visibility);

(vi) joining a circuit;

(vii) bad weather circuit, approach and landing.

EXERCISE 18c: USE OF RADIO NAVIGATION AIDS UNDER VFR

(a) Long briefing objectives:

(1) use of VOR:

(i) availability, AIP and frequencies;

(ii) signal reception range;

(iii) selection and identification;

(iv) radials and method of numbering;

(v) use of OBS;

(vi) to or from indication and station passage;

(vii) selection, interception and maintaining a radial;

(viii) use of two stations to determine position.

(2) use of ADF equipment:

(i) availability of NDB stations, AIP and frequencies;

(ii) signal reception range;

(iii) selection and identification;

(iv) orientation in relation to NDP;

(v) homing to an NDP.

(3) use of VHF/DF:

(i) availability. AIP and frequencies;

(ii) R/T procedures;

(iii) obtaining QDMs and QTEs.

(4) use of radar facilities:

(i) availability and provision of service and AIS;

(ii) types of service;

(iii) R/T procedures and use of transponder:

(A) mode selection;

(B) emergency codes.

(5) use of distance DME:

(i) availability and AIP;

(ii) operating modes;

(iii) slant range.

(6) use of GNSS (RNAV – SATNAV):

(i) availability;

(ii) operating modes;

(iii) limitations.

(b) Air exercise:

(1) use of VOR:

(i) availability, AIP and frequencies;

(ii) selection and identification;

(iii) use of OBS;

(iv) to or from indications: orientation;

(v) use of CDI;

(vi) determination of radial;

(vii) intercepting and maintaining a radial;

(viii) VOR passage;

(ix) obtaining a fix from two VORs.

(2) use of ADF equipment;

(i) availability of NDB stations, AIP and frequencies;

(ii) selection and identification;

(iii) orientation relative to the beacon;

(iv) homing.

(3) use of VHF/DF:

(i) availability, AIP and frequencies;

(ii) R/T procedures and ATC liaison;

(iii) obtaining a QDM and homing.

(4) use of en-route or terminal radar:

(i) availability and AIP;

(ii) procedures and ATC liaison;

(iii) pilot's responsibilities;

(iv) secondary surveillance radar;

(v) transponders;

(vi) code selection;

(vii) interrogation and reply.

(5) use of DME:

(i) station selection and identification;

(ii) modes of operation.

(6) use of GNSS (RNAV – SATNAV):

(i) setting up;

(ii) operation;

(iii) interpretation.

EXERCISE 19: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:

(1) flight instruments;

(i) physiological sensations;

(ii) instrument appreciation;

(iii) attitude instrument flight;

(iv) pitch indications;

(v) bank indications;

(vi) different dial presentations;

(vii) introduction to the use of the attitude indicator;

(viii) pitch attitude;

(ix) bank attitude;

(x) maintenance of heading and balanced flight;

(xi) instrument limitations (inclusive system failures).

(2) attitude, power and performance;

(i) attitude instrument flight:

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power and configuration;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan;

(3) basic flight manoeuvres (full panel);

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns onto pre-selected headings:

(A) level;

(B) climbing;

(C) descending.

(b) Air exercise:

(1) Introduction to instrument flying

(i) flight instruments;

(ii) physiological sensations;

(iii) instrument appreciation;

(iv) attitude instrument flight;

(v) pitch attitude;

(vi) bank attitude;

(vii) maintenance of heading and balanced flight;

(2) attitude, power and performance;

(i) attitude instrument flight;

(ii) effect of changing power and configuration;

(iii) cross-checking the instruments;

(iv) selective radial scan;

(3) basic flight manoeuvres (full panel);

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns onto pre-selected headings:

(A) level;

(B) climbing;

(C) descending.

EXERCISE 20: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) start up procedures;

(2) local procedures: including ATC liaison;

(3) taxiing:

(i) parking area and taxiway lighting;

(ii) judgement of speed and distances;

(iii) use of taxiway lights;

(iv) avoidance of hazards: obstruction lighting;

(v) instrument checks;

(vi) holding point: lighting procedure;

(vii) initial familiarisation at night;

(viii) local area orientation;

(ix) significance of lights on other aircraft;

(x) ground obstruction lights;

(xi) division of piloting effort: external or instrument reference;

(xii) rejoining procedure;

(xiii) aerodrome lighting: approach and runway lighting (including VASI and PAPI):

(A) threshold lights;

(B) approach lighting;

(C) visual approach slope indicator systems.

(4) night circuits;

(i) take-off and climb:

(A) line up;

(B) visual references during the take-off run;

(C) transfer to instruments;

(D) establishing the initial climb;

(E) use of flight instruments;

(F) instrument climb and initial turn.

(ii) circuit:

(A) aeroplane positioning: reference to runway lighting;

(B) the traffic pattern and look-out;

(C) initial approach and runway lighting demonstration;

(D) aeroplane positioning;

(E) changing aspect of runway lights and VASI (or PAPI);

(F) intercepting the correct approach path;

(G) the climb away.

(iii) approach and landing:

(A) positioning, base leg and final approach;

(B) diurnal wind effect;

(C) use of landing lights;

(D) the flare and touchdown;

(E) the roll out;

(F) turning off the runway: control of speed.

(iv) missed approach:

(A) use of instruments;

(B) re-positioning in the circuit pattern;

(5) night navigation:

(i) particular emphasis on flight planning;

(ii) selection of ground features visible at night:

(A) air light beacons;

(B) effect of cockpit lighting on map colours;

(C) use of radio aids;

(D) effect of moonlight upon visibility at night;

(iii) emphasis on maintaining a 'minimum safe altitude';

(iv) alternate aerodromes: restricted availability;

(v) restricted recognition of weather deterioration;

(vi) lost procedures;

(6) night emergencies;

(i) radio failure;

(ii) failure of runway lighting;

(iii) failure of aeroplane landing lights;

(iv) failure of aeroplane internal lighting;

(v) failure of aeroplane navigation lights;

(vi) total electrical failure;

(vii) abandoned take-off;

(viii) engine failure;

(ix) obstructed runway procedure.

(b) Air exercise: during the air exercise all long briefing objectives mentioned above should also be trained on site and the student instructor should demonstrate the following items:

(1) how to plan and to perform a flight at night;

(2) how to advise the student pilot to plan and prepare a flight at night;

(3) how to advise the student pilot to perform a flight at night;

(4) how to analyse and correct errors as necessary.

B. Helicopters

GROUND INSTRUCTION

Note: During ground instruction the student instructor should pay specific attention to the teaching of enhanced ground instruction in weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conduction a precautionary landing.

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(H) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment;

(6) applicability of the exercises to the helicopter type.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the objectives and a brief reference to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted about who is to fly the helicopter and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

(1) the aim;

(2) principles of flight (briefest reference only);

(3) the air exercise(s) (what, and how and by whom);

(4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(H) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(H).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) If the privileges of the FI(H) certificate are to include instruction for night flying, exercise 28 should be undertaken either as part of the course or subsequent to certificate issue.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

(l) The student instructor should be trained to keep in mind that wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: FAMILIARISATION WITH THE HELICOPTER

(a) Long briefing objectives:

(1) introduction to the helicopter;

(2) explanation of the cockpit layout;

(3) helicopter and engine systems;

(4) checklist(s) and procedures;

(3) familiarisation with the helicopter controls;

(4) differences when occupying the instructor's seat;

(5) emergency drills:

(i) action if fire in the air and on the ground: engine, cockpit or cabin and electrical fire;

(ii) system failure drills as applicable to type;

(iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

(1) flight authorisation and helicopter acceptance, including technical log (if applicable) and certificate of maintenance:

(2) equipment required for flight (maps, etc.);

(3) external checks;

(4) internal checks;

(5) student comfort, harness, seat and rudder pedal adjustment;

(6) starting and after starting checks;

(7) system, power or serviceability checks (as applicable);

(8) closing down or shutting down the helicopter (including system checks).

(9) parking and leaving the helicopter (including safety or security as applicable);

(10) completion of authorisation sheet and helicopter serviceability documents.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of the flying controls (primary and secondary effect);

(2) effect of air speed;

(3) effect of power changes (torque);

(4) effect of yaw (sideslip);

(5) effect of disc loading (bank and flare);

(6) effect on controls of selecting hydraulics on/off;

(7) effect of control friction;

(8) use of instruments;

(9) operation of carburettor heat or anti-icing control.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 5: POWER AND ATTITUDE CHANGES

(a) Long briefing objectives:

(1) relationship between cyclic control position, disc attitude, fuselage attitude and air speed flap back;

(2) power required diagram in relation to air speed;

(3) power and air speed changes in level flight;

(4) use of the instruments for precision;

(5) engine and air speed limitations;

(b) Air exercise:

(1) relationship between cyclic control position, disc attitude, fuselage attitude and air speed flap back;

(2) power and air speed changes in level flight;

(3) use of instruments for precision (including instrument scan and look-out).

EXERCISE 6: LEVEL FLIGHT, CLIMBING, DESCENDING AND TURNING

Note: for ease of training this exercise is divided into four separate parts in the PPL(H) syllabus but may be taught complete or in convenient parts.

(a) Long briefing objectives:

(1) basic factors involved in level flight;

(2) normal power settings;

(3) use of control friction or trim;

(4) importance of maintaining direction and balance;

(5) power required or power available diagram;

(6) optimum climb and descent speeds, angles or rates;

(7) importance of balance, attitude and co-ordination in the turn;

(8) effects of turning on rate of climb or descent;

(9) use of the gyro direction or heading indicator and compass;

(10) use of instruments for precision.

(b) Air exercises:

(1) maintaining straight and level flight at normal cruise power;

(2) control in pitch, including use of control friction or trim;

(3) use of the ball or yaw string to maintain direction and balance;

(4) setting and use of power for selected air speeds and speed changes;

(5) entry to climb;

(6) normal and maximum rate of climb;

(7) levelling off from climb at selected altitudes or heights;

(8) entry to descent;

(9) effect of power and air speed on rate of descent;

(10) levelling off from descent at selected altitudes or heights;

(11) entry to medium rate turns;

(12) importance of balance, attitude and co-ordination to maintain level turn;

(13) resuming straight and level flight;

(14) turns onto selected headings, use of direction indicator and compass;

(15) turns whilst climbing and descending;

(16) effect of turn on rate of climb or descent;

(17) use of instruments for precision (including instrument scan and look-out).

EXERCISE 7: AUTOROTATION

(a) Long briefing objectives:

(1) characteristics of autorotation;

(2) safety checks (including look-out and verbal warning);

(3) entry and development of autorotation;

(4) effect of AUM, IAS, disc loading, G forces and density altitude on RRPM and rate of descent;

(5) rotor and engine limitations;

(6) control of air speed and RRPM;

(7) recovery to powered flight;

(8) throttle override and control of ERPM or RRPM during re-engagement (as applicable);

(9) danger of vortex condition during recovery.

(b) Air exercise:

(1) safety checks (including verbal warning and look-out);

(2) entry to and establishing in autorotation;

(3) effect of IAS and disc loading on RRPM and rate of descent;

(4) control of air speed and RRPM;

(5) recovery to powered flight;

(6) medium turns in autorotation;

(7) simulated engine off landing (as appropriate).

EXERCISE 8: HOVERING AND HOVER TAXIING

(a) Long briefing objectives:

(1) ground effect and power required;

(2) effect of wind, attitude and surface;

(3) stability in hover and effects of over controlling;

(4) effect of control in hover;

(5) control and co-ordination during spot turns;

(6) requirement for slow hover speed to maintain ground effect;

(7) effect of hydraulic failure in hover;

(8) specific hazards, for example snow, dust, etc.

(b) Air exercise:

(1) ground effect and power or height relationship;

(2) effect of wind, attitude and surface;

(3) stability in hover and effects of over controlling;

(4) effect of control and hover technique;

(5) gentle forward running touchdown;

(6) control and co-ordination during spot (90 ° clearing) turns;

(7) control and co-ordination during hover taxi;

(8) dangers of mishandling and over pitching;

(9) (where applicable) effect of hydraulics failure in hover;

(10) simulated engine failure in the hover and hover taxi.

EXERCISE 9: TAKE-OFF AND LANDING

(a) Long briefing objectives:

(1) pre take-off checks or drills;

(2) importance of good look-out;

(3) technique for lifting to hover;

(4) after take-off checks;

(5) danger of horizontal movement near ground;

(6) dangers of mishandling and over pitching;

(7) technique for landing;

(8) after landing checks;

(9) take-off and landing crosswind and downwind.

(b) Air exercise:

(1) pre take-off checks or drills:

(2) pre take-off look-out technique;

(3) lifting to hover;

(4) after take-off checks;

(5) landing;

(6) after landing checks or drills;

(7) take-off and landing crosswind and downwind.

EXERCISE 10: TRANSITIONS FROM HOVER TO CLIMB AND APPROACH TO HOVER

(a) Long briefing objectives:

(1) revision of ground effect;

(2) translational lift and its effects;

(3) inflow roll and its effects;

(4) revision of flap back and its effects;

(5) avoidance of curve diagram and associated dangers;

(6) effect or dangers of wind speed and direction during transitions;

(7) transition to climb technique;

(8) constant angle approach;

(9) transition to hover technique.

(b) Air exercise:

(1) revision of take-off and landing;

(2) transition from hover to climb;

(3) effect of translational lift, inflow roll and flap back;

(4) constant angle approach;

(5) technique for transition from descent to hover;

(6) a variable flare simulated engine off landing.

EXERCISE 11: CIRCUIT, APPROACH AND LANDING

(a) Long briefing objectives:

(1) circuit and associated procedures;

(2) take-off and climb (including checks or speeds);

(3) crosswind leg (including checks, speeds or angles of bank in turns);

(4) downwind leg (including pre-landing checks);

(5) base leg (including checks, speeds or angles of bank in turns);

(6) final approach (including checks or speeds);

(7) effect of wind on approach and hover IGE;

(8) crosswind approach and landing technique;

(9) missed approach and go-around technique (as applicable);

(10) steep approach technique (including danger of high sink rate);

(11) limited power approach technique (including danger of high speed at touchdown);

(12) use of the ground effect;

(13) abandoned take-off technique;

(14) hydraulic failure drills and hydraulics off landing technique (where applicable);

(15) drills or technique for tail rotor control or tail rotor drive failure;

(16) engine failure drills in the circuit to include;

(17) engine failure

(18) on take-off:

(i) crosswind;

(ii) downwind;

(iii) base leg;

(iv) on final approach.

(19) noise abatement procedures (as applicable).

(b) Air exercise:

(1) revision of transitions and constant angle approach;

(2) basic training circuit, including checks;

(3) crosswind approach and landing technique;

(4) missed approach and go-around technique (as applicable);

(5) steep approach technique;

(6) basic limited power approach or run on technique;

(7) use of ground effect;

(8) hydraulic failure and approach to touchdown with hydraulics off and to recover at safe height (as applicable);

(9) simulated engine failure on take-off, crosswind, downwind, base leg and finals;

(10) variable flare simulated engine off landing.

EXERCISE 12: FIRST SOLO

(a) Long briefing objectives:

(1) warning of change of attitude due to reduced and laterally displaced weight;

(2) low tail, low skid or wheel during hover or landing;

(3) dangers of loss of RRPM and over pitching;

(4) pre take-off checks;

(5) into wind take-off;

(6) drills during and after take-off;

(7) normal circuit, approach and landing;

(8) action if an emergency.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 13: SIDEWAYS AND BACKWARDS HOVER MANOEUVRING

(a) Long briefing objectives:

(1) revision of hovering;

(2) directional stability and weather cocking effect;

(3) danger of pitching nose down on recovery from backwards manoeuvring;

(4) helicopter limitations for sideways and backwards manoeuvring;

(5) effect of CG position.

(b) Air exercise:

(1) revision of hovering and 90 ° clearing turns;

(2) manoeuvring sideways heading into wind;

(3) manoeuvring backwards heading into wind;

(4) manoeuvring sideways and backwards heading out of wind;

(5) manoeuvring backwards too fast and recovery action.

EXERCISE 14: SPOT TURNS

(a) Long briefing objectives:

(1) revision of ground effect and effect of wind;

(2) weather cocking and control actions;

(3) control of RRPM;

(4) torque effect;

(5) cyclic limiting stops due to CG position (where applicable);

(6) rate of turn limitations;

(7) spot turn about pilot position;

(8) spot turn about tail rotor position;

(9) spot turn about helicopter geometric centre;

(10) square (safe visibility) and clearing turn.

(b) Air exercise:

(1) weather cocking, torque effect and control actions;

(2) rate of turn;

(3) spot turn about pilot position;

(4) spot turn about tail rotor position;

(5) spot turn about helicopter geometric centre;

(6) square and clearing turn.

EXERCISE 15: HOVER OUT OF GROUND EFFECT AND VORTEX RING

(a) Long briefing objectives:

(1) revision of ground effect and power required diagram;

(2) drift, height and power control, look-out or scan;

(3) vortex ring, (including dangers, recognition and recovery actions);

(4) loss of tail rotor effectiveness.

(b) Air exercise:

(1) to demonstrate hover OGE;

(2) drift, height, power control and look-out, and instrument scan technique;

(3) recognition of incipient stage of vortex ring and settling with power;

(4) recovery action from incipient stage of vortex ring;

(5) recognition of loss of tail rotor effectiveness and recovery actions.

EXERCISE 16: SIMULATED ENGINE OFF LANDINGS

(a) Long briefing objectives:

(1) revision of basic autorotation;

(2) effect of AUM, disc loading, density altitude and RRPM decay;

(3) use of cyclic and collective to control speed or RRPM;

(4) torque effect;

(5) use of flare or turn to restore RRPM;

(6) technique for variable flare simulated EOL;

(7) technique for constant attitude simulated EOL;

(8) revision of technique for hover or hover taxi simulated EOL;

(9) emergency technique for engine failure during transition;

(10) technique for low level simulated EOL.

(b) Air exercise

(1) revision of entry to and control in autorotation;

(2) variable flare simulated EOL

(3) constant attitude simulated EOL;

(4) hover simulated EOL;

(5) hover taxi simulated EOL;

(6) low level simulated EOL.

EXERCISE 17: ADVANCED AUTOROTATIONS

(a) Long briefing objectives:

(1) effect of air speed or AUM on angles or rates of descent

(2) effect of RRPM setting on angle or rate of descent;

(3) reason and technique for range autorotation;

(4) reason and technique for constant attitude autorotation;

(5) reason and technique for low speed and ‘S’ turns in autorotation;

(6) speed or bank limitations in turns in autorotation;

(7) revision of re-engagement or go-around procedures.

(b) Air exercise:

(1) selection of ground marker and standard datum height to determine distance covered during various autorotation techniques;

(2) revision of basic autorotation;

(3) technique for range autorotation;

(4) technique for constant attitude autorotation;

(5) technique for low speed autorotation, including need for timely speed recovery;

(6) technique for ‘S’ turn in autorotation;

(7) 180 and 360 ° turns in autorotation;

(8) revision of re-engagement and go-around technique.

EXERCISE 18: PRACTICE FORCED LANDINGS

(a) Long briefing objectives:

(1) types of terrain or surface options for choice of best landing area;

(2) practice forced landing procedure;

(3) forced landing checks and crash actions;

(4) rules or height for recovery and go-around.

(b) Air exercise:

(1) recognition of types of terrain from normal cruise height or altitude;

(2) practice forced landing technique;

(3) revision of recovery or go-around technique.

EXERCISE 19: STEEP TURNS

(a) Long briefing objectives:

(1) air speed or angle of bank limitations;

(2) technique for co-ordination to hold bank or attitude;

(3) revision of speed or bank limitations in autorotation including RRPM control;

(4) significance of disc loading, vibration and control feedback;

(5) effect of wind in turns at low level.

(b) Air exercise:

(1) technique for turning at 30 ° of bank;

(2) technique for turning at 45 ° of bank (where possible);

(3) steep autorotative turns;

(4) explanation of faults in the turn: balance, attitude, bank and co-ordination;

(5) effect of wind at low level.

EXERCISE 20: TRANSITIONS

(a) Long briefing objectives:

(1) revision of effect of ground cushion, translational lift and flap back;

(2) training requirement for precision exercise;

(3) technique for transition to forward flight and back to hover as precision exercise;

(4) effect of wind.

(b) Air exercise:

(1) transition from hover to minimum 50 knots IAS and back to hover;

Note: select constant height (20 - 30 ft) and maintain.

(2) effect of wind.

EXERCISE 21: QUICK STOPS

(a) Long briefing objectives:

(1) power control co-ordination;

(2) revision of effect of wind;

(3) technique for quick stop into wind;

(4) technique for quick stop from crosswind;

(5) revision of air speed and angles of bank limitations;

(6) technique for emergency turn from downwind;

(7) technique for quick stop from downwind from high speed: flare and turn;

(8) technique for quick stop from downwind from low speed: turn and flare;

Note: use reasonable datum speed for example high speed, low speed.

(9) danger of holding flare when downwind, (vortex ring) - (minimum speed 70 knots);

(10) to revise danger of high disc loading.

(b) Air exercise:

(1) technique for quick stop into wind;

(2) technique for quick stop from crosswind;

(3) danger of vortex ring and disc loading;

(4) technique for quick stop from downwind with low speed;

(5) technique for quick stop from downwind with high speed;

(6) emergency turns from downwind.

EXERCISE 22: NAVIGATION

(a) Long briefing objectives:

Note: to be broken down into manageable parts at discretion of instructor.

(1) flight planning:

(i) weather forecasts and actuals;

(ii) map selection, orientation, preparation and use:

(A) choice of route;

(B) regulated or controlled airspace;

(C) danger, prohibited and restricted areas;

(D) safety altitude.

(iii) calculations:

(A) magnetic heading(s), time(s) en route;

(B) fuel consumption;

(C) mass and balance.

(iv) flight information:

(A) NOTAMs etc;

(B) noting of required radio frequencies;

(C) selection of alternate landing sites.

(v) helicopter documentation;

(vi) notification of the flight:

(A) pre-flight administration procedures;

(B) flight plan form (where appropriate).

(2) departure:

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) ATC liaison in controlled or regulated airspace;

(C) setting heading procedure;

(D) noting of ETA(s);

(E) maintenance of height or altitude and heading.

(iii) procedure for revisions of ETA and headings to include:

(A) 10 ° line, double track, track error and closing angle;

(B) 1 in 60 rule;

(iv) amending an ETA;

(v) log keeping;

(vi) use of radio;

(vii) use of navaids;

(viii) weather monitoring and minimum weather conditions for continuation of flight;

(ix) significance of in-flight decision making;

(x) technique for transiting controlled or regulated airspace;

(xi) uncertainty of position procedure;

(xii) lost procedure.

(3) arrival:

(i) aerodrome joining procedure, in particular ATC liaison in controlled or regulated airspace:

(A) altimeter setting;

(B) entering traffic pattern;

(C) circuit procedures.

(ii) parking procedures, in particular:

(A) security of helicopter;

(B) refuelling;

(C) closing of flight plan, (if appropriate);

(D) post flight administrative procedures.

(4) navigation problems at low heights and reduced visibility:

(i) actions before descending;

(ii) significance of hazards, (for example obstacles and other traffic);

(iii) difficulties of map reading;

(iv) effects of wind and turbulence;

(v) significance of avoiding noise sensitive areas;

(vi) procedures for joining a circuit from low level;

(vii) procedures for a bad weather circuit and landing;

(viii) actions in the event of encountering DVE;

(ix) appropriate procedures and choice of landing area for precautionary landings;

(x) decision to divert or conduct precautionary landing;

(xi) precautionary landing.

(5) radio navigation:

(i) use of VOR:

(A) availability, AIP and frequencies;

(B) selection and identification;

(C) use of OBS;

(D) to or from indications: orientation;

(E) use of CDI;

(F) determination of radial;

(G) intercepting and maintaining a radial;

(H) VOR passage;

(I) obtaining a fix from two VORs.

(ii) use of ADF equipment:

(A) availability of NDB stations, AIP and frequencies;

(B) selection and identification;

(C) orientation relative to beacon;

(D) homing.

(iii) use of VHF/DF

(A) availability, AIP and frequencies;

(B) R/T procedures and ATC liaison;

(C) obtaining a QDM and homing.

(iv) use of en-route or terminal radar:

(A) availability and AIP;

(B) procedures and ATC liaison;

(C) pilots responsibilities;

(D) secondary surveillance radar:

(a) transponders;

(b) code selection;

(E) interrogation and reply.

(iv) use of DME:

(A) station selection and identification;

(B) modes of operation: distance, groundspeed and time to run.

(v) use of GNSS:

(A) selection of waypoints;

(B) to or from indications and orientation;

(C) error messages;

(D) hazards of over-reliance in the continuation of flight in DVE.

(b) Air exercise:

(1) navigation procedures as necessary;

(2) to advise student and correct errors as necessary;

(3) map reading techniques;

(4) the significance of calculations;

(5) revision of headings and ETA's;

(6) use of radio;

(7) use of navaids: ADF/NDB, VOR, VHF/DF, DME and transponder;

(8) cross-country flying by using visual reference, DR, GNNS and, where available, radio navigation aids; simulation of deteriorating weather conditions and actions to divert or conduct precautionary landing;

(8) log keeping;

(9) importance of decision making;

(10) procedure to deal with uncertainty of position;

(11) lost procedure;

(12) appropriate procedures and choice of landing area for precautionary landings;

(13) aerodrome joining procedure;

(14) parking and shut-down procedures;

(15) post-flight administration procedures.

EXERCISE 23: ADVANCED TAKE-OFF, LANDINGS AND TRANSITIONS

(a) Long briefing objectives:

(1) revision of landing and take-off out of wind (performance reduction);

(2) revision of wind limitations;

(3) revision of directional stability variation when out of wind;

(4) revision of power required diagram;

(5) technique for downwind transitions;

(6i) technique for vertical take-off over obstacles;

(7) reconnaissance technique for landing site;

(8) power checks;

(9) technique for running landing;

(10) technique for zero speed landing;

(11) technique for crosswind and downwind landings;

(12) steep approach, including dangers;

(13) revision of go-around procedures.

(b) Air exercise

(1) technique for downwind transition;

(2) technique for vertical take-off over obstacles;

(3) reconnaissance technique for landing site;

(4) power check and assessment;

(5) technique for running landing;

(6) technique for zero speed landing;

(7) technique for crosswind and downwind landings;

(8) technique for steep approach;

(9) go-around procedures.

EXERCISE 24: SLOPING GROUND

(a) Long briefing objectives:

(1) limitations;

(2) wind and slope relationship, including blade and control stops;

(3) effect of CG when on slope;

(4) ground effect and power required when on slope;

(5) landing technique when on slope, left, right and nose-up;

(6) avoidance of dynamic rollover, dangers of soft ground and sideways movement;

(7) dangers of over controlling near ground on slope;

(8) danger of striking main or tail rotor on up slope.

(b) Air exercise

(1) technique for assessing slope angle;

(2) technique for landing and take-off left skid up slope;

(3) technique for landing and take-off right skid up slope;

(4) technique for landing nose up slope;

(5) dangers of over controlling near ground.

EXERCISE 25: LIMITED POWER

(a) Long briefing objectives:

(1) use of appropriate helicopter performance graphs;

(2) selection of technique according to available power;

(3) effect of wind on available power.

(b) Air exercise: to revise and refine techniques demonstrated in exercise 23.

EXERCISE 26: CONFINED AREAS

(a) Long briefing objectives:

(1) revision of use of helicopter performance graphs;

(2) procedure for locating landing site and selecting site marker;

(3) procedures for assessing wind speed and direction;

(4) landing site reconnaissance techniques;

(5) reason for selecting landing markers;

(6) procedure for selecting direction and type of approach;

(7) dangers of out of wind approach;

(8) circuit procedures;

(9) reason for approach to committal point and go-around, (practice approach);

(10) approach technique;

(11) revision of clearing turn and landing (sloping ground technique);

(12) hover power check or performance assessment IGE and OGE (if necessary);

(13) take-off procedures.

(b) Air exercise

(1) procedures for locating landing site and selecting site marker;

(2) procedures for assessing wind speed and direction;

(3) landing site reconnaissance techniques;

(4) selecting landing markers, direction and type of approach;

(5) circuit procedure;

(6) practice approach, go-around and approach technique;

(7) revision of clearing turn and landing (sloping ground technique);

(8) hover power check or performance assessment IGE and OGE (if necessary);

(9) take-off procedures.

EXERCISE 27: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) instrument scan;

(5) instrument limitations;

(6) basic manoeuvres by sole reference to instruments:

(i) straight and level flight at various air speeds and configurations;

(ii) climbing and descending;

(iii) standard rate turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns (unusual attitudes).

(b) Air exercise:

(1) attitude instrument flight and instrument scan;

(2) basic manoeuvres by sole reference to instruments:

(i) straight and level flight at various air speeds and configurations;

(ii) climbing and descending;

(iii) standard rate turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns (unusual attitudes).

EXERCISE 28: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) medical or physiological aspects of night vision;

(2) requirement for torch to be carried (pre-flight inspection, etc.);

(3) use of the landing light;

(4) take-off and hover taxi procedures at night;

(5) night take-off procedure;

(6) cockpit procedures at night;

(7) approach techniques;

(8) night landing techniques;

(9) night autorotation techniques (power recovery at safe height);

(10) technique for practice forced landing at night (using appropriate illumination);

(11) emergency procedures at night;

(12) navigation principles at night;

(13) map marking for night use (highlighting built up or lit areas with thicker lines, etc.).

(b) Air exercise:

(1) use of torch for pre-flight inspection;

(2) use of landing light;

(3) night take-off to hover (no sideways or backwards movement);

(4) night hover taxi (higher and slower than by day);

(5) night transition procedure;

(6) night circuit;

(7) night approach and landing (including use of landing light);

(8) night autorotation (power recovery at safe height);

(9) practice forced landing at night (using appropriate illumination);

(10) night emergency procedures;

(11) night cross country techniques, as appropriate.

C. Airships

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(As) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted about who is to fly the airship and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

(1) the aim;

(2) principles of flight (briefest reference only);

(3) the air exercise(s) (what, and how and by whom);

(4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(As) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(As).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) The exercises 15 and 16 of the flight instruction syllabus should be undertaken at night in addition to by day as part of the course.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

LONG BRIEFINGS AND AIR EXERCISES

Note: although exercise 16 is not required for the PPL(As) course it is a requirement for the FI(As) course.

EXERCISE 1: FAMILIARISATION WITH THE AIRSHIP

(a) Long briefing objectives:

(1) introduction to the airship;

(2) characteristics of the airship;

(3) cockpit layout;

(4) airship and engine systems;

(5) use of the checklist(s) and procedures;

(6) to familiarise the student with the airship controls;

(7) differences when occupying the instructor's seat;

(8) emergency drills:

(i) action if fire in the air or on the ground: engine, cockpit or cabin and electrical fire;

(ii) system failure drills as applicable to type;

(iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

(1) flight authorisation and airship acceptance including tech log (if applicable) and certificate of maintenance;

(2) equipment required for flight (maps, etc.);

(3) external checks;

(4) internal checks;

(5) student comfort, harness, seat and rudder pedal adjustment;

(6) starting and after starting checks;

(7) system, power or serviceability checks (as applicable);

(8) closing down or shutting down the airship (including system checks);

(9) parking, masting and unmasting, leaving the airship (including safety or security as applicable);

(10) completion of the authorisation sheet and airship serviceability documents;

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of the flying controls (primary and secondary effect);

(2) effect of air speed;

(3) effect of power changes;

(4) effect of trimming and other controls;

(5) use of instruments;

(6) use of carburettor heat.

(b) Air exercise:

(1) function of the flying controls;

(2) effect of air speed;

(3) effect of power changes;

(4) effect of trimming and other controls;

(5) use of instruments (including instrument scan);

(6) use of carburettor heat.

EXERCISE 5: GROUND MANOEUVERING

(a) Long briefing objectives:

(1) pre-taxi checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) masting procedures;

(5) control of direction and turning;

(6) effects of wind;

(7) effects of ground surface;

(8) marshalling signals;

(9) instrument checks;

(10) ATC procedures;

(11) emergencies.

(b) Air exercise:

(1) starting, control of speed and stopping;

(2) engine handling;

(3) masting procedures;

(4) control of direction and turning;

(5) effect of wind.

EXERCISE 6: TAKE-OFF PROCEDURES

(a) Long briefing objectives:

(1) pre take-off checks;

(2) take-off with different static heaviness;

(3) drills during and after take-off;

(4) noise abatement procedures.

(b) Air exercise:

(1) take-off with different static heaviness;

(2) drills during and after take-off.

EXERCISE 6e: EMERGENCIES

(a) Long briefing objectives:

(1) abandoned take-off;

(2) engine failures and actions after take-off;

(3) malfunctions of thrust vector control;

(4) aerodynamic control failures;

(5) electrical and system failures.

(b) Air exercise:

(1) how to abandon a take-off;

(2) engine failure and suitable action;

(3) malfunctions of thrust vector control;

(4) aerodynamic control failures.

EXERCISE 7: CLIMBING

(a) Long briefing objectives:

(1) entry and how to maintain the normal and max rate of climb;

(2) levelling off procedure;

(3) how to level off at selected altitudes;

(4) maximum angle of climb;

(5) maximum rate of climb.

(b) Air exercise:

(1) how to level off at selected altitudes;

(2) maximum angle of climb.

EXERCISE 8: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) how to attain and maintain straight and level flight;

(2) flight at or close to pressure height;

(3) control in pitch, including use of trim;

(4) at selected air speeds (use of power);

(5) during speed changes;

(6) use of instruments for precision.

(b) Air exercise:

(1) how to attain and maintain straight and level flight;

(2) flight at or close to pressure height;

(3) control in pitch, including use of trim;

(4) at selected air speeds (use of power);

(5) during speed changes.

EXERCISE 9: DESCENDING

(a) Long briefing objectives:

(1) entry, maintaining and levelling off techniques;

(2) levelling off at selected altitudes;

(3) maximum rate of descent;

(4) maximum angle of descent;

(5) use of instruments for precision flight.

(b) Air exercise:

(1) levelling off at selected altitudes;

(2) maximum rate of descent;

(3) maximum angle of descent.

EXERCISE 10: TURNING

(a) Long briefing objectives:

(1) entry and maintaining level turns;

(2) resuming straight flight;

(3) faults in the turn;

(4) climbing turns;

(5) descending turns;

(6) turns to selected headings: use of gyro heading indicator and compass;

(7) use of instruments for precision.

(b) Air exercise

(1) faults in the turn and correction techniques;

(2) climbing turns;

(3) descending turns.

EXERCISE 11: HOVERING

(a) Long briefing objectives: hovering manoeuvres (as applicable).

(b) Air exercise: hovering manoeuvres (as applicable).

EXERCISE 12: APPROACH AND LANDING

(a) Long briefing objectives:

(1) effect of wind on approach and touchdown speeds;

(2) landing with different static heaviness;

(3) missed approach and go-around procedures;

(4) noise abatement procedures.

(b) Air exercise

(1) a landing with different static heaviness;

(2) missed approach and go-around procedures.

EXERCISE 12e: EMERGENCIES

(a) Long briefing objectives:

(1) aborted approach or go-around;

(2) malfunction of thrust vector control;

(3) envelope emergencies;

(4) fire emergencies;

(5) aerodynamic control failures;

(6) electrical and system failures.

(b) Air exercise: emergency drills and actions.

EXERCISE 13: PRECAUTIONARY LANDING

(a) Long briefing objectives:

(1) occasions necessitating a precautionary landing;

(2) in-flight conditions;

(3) landing area selection;

(4) circuit and approach.

(b) Air exercise:

(1) how to perform the landing area selection;

(2) circuit and approach.

EXERCISE 14a: NAVIGATION

(a) Long briefing objectives:

(1) how to do the flight planning;

(2) departure for a navigation flight;

(3) in-flight navigational techniques;

(4) arrival and aerodrome joining procedures;

(b) Air exercise:

(1) complete flight planning of a navigation flight;

(2) departure for a navigation flight;

(3) in-flight navigational techniques;

(4) arrival and aerodrome joining procedures.

EXERCISE 14b: NAVIGATION AT LOWER LEVELS AND IN REDUCED VISIBILITY

(a) Long briefing objectives:

(1) actions before descending;

(2) possible hazards (for example obstacles and terrain) and actions;

(3) student difficulties of map reading;

(4) effects of winds, turbulence and precipitation;

(5) vertical situational awareness;

(6) avoidance of noise sensitive areas;

(7) joining the circuit;

(8) bad weather circuit and landing.

(b) Air exercise:

(1) actions before descending;

(2) map reading techniques;

(3) vertical situational awareness;

(4) avoidance of noise sensitive areas;

(5) joining the circuit;

(6) bad weather circuit and landing.

EXERCISE 14c: RADIO NAVIGATION

(a) Long briefing objectives:

(1) use of VOR;

(2) use of ADF equipment;

(3) use of NDB stations;

(4) use of VHF/DF;

(5) use of en-route or terminal radar;

(6) use of DME equipment.

(b) Air exercise

(1) use of navaids;

(2) procedure to deal with uncertainty of position.

EXERCISE 15: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) instrument scan;

(5) instrument limitations;

(6) basic manoeuvres by sole reference to the instruments:

(i) straight and level;

(ii) climbing and descending;

(iii) turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns.

(b) Air exercise:

(1) attitude instrument flight and instrument scan;

(2) the basic manoeuvres:

(i) straight and level;

(ii) climbing and descending;

(iii) turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns.

EXERCISE 16: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) medical and physiological aspects of night vision;

(2) requirement for torch to be carried (pre-flight inspection, etc.);

(3) use of the landing light;

(4) ground manoeuvring procedures at night;

(5) night take-off procedure;

(6) cockpit procedures at night;

(7) approach techniques;

(8) night landing techniques

(9) emergency procedures at night;

(10) navigation principles at night.

(b) Air exercise:

(1) use of landing light;

(2) night ground manoeuvring;

(3) night take-off, circuit or approach and landing (including use of landing light).

AMC2 FCL.930.FI FI — Training course

FI(S) AND FI(B) TRAINING COURSE

GENERAL

(a) The aim of the FI(S) and FI(B) training course is to train SPL and BPL holders to the level of competence defined in FCL.920 as instructor competencies.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the FI task including at least the following:

(1) refresh the technical knowledge of the student instructor;

(2) train the student instructor to teach the ground subjects and air exercises;

(3) ensure that the student instructor's flying is of a sufficiently high standard; and

(4) teach the student instructor the principles of basic instruction and to apply them at all training levels.

(c) With the exception of the section on teaching and learning, all the subject detail contained in the ground and flight training syllabus is complementary to the SPL and BPL course syllabus.

(d) The FI training course should give particular stress to the role of the individual in relation to the importance of human factors in the man-machine and theoretical knowledge environment interaction. Special attention should be paid to the applicant's maturity and judgement including an understanding of adults, their behavioural attitudes and variable levels of education.

(e) During the training course, the applicants should be made aware of their own attitudes to the importance of flight safety. Improving safety awareness should be a fundamental objective throughout the training course. It will be of major importance for the training course to aim at giving applicants the knowledge, skills and attitudes relevant to a flight instructor's task.

(f) On successful completion of the training course and final test the applicant may be issued with an FI certificate.

CONTENT

(g) The training course consists of two parts:

(1) Part 1, theoretical knowledge including the teaching and learning instruction that should comply with AMC1 FCL.920;

(2) Part 2, flight instruction.

Part 1
The content of the teaching and learning part of the FI course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

The course should include at least 55 hours of theoretical knowledge including at least 25 hours teaching and learning instructions for the FI (S) and FI(B) certificate.

Part 2
FLIGHT INSTRUCTION SYLLABUS
An approved FI training course should comprise at least the minimum hours of flight instruction as defined in FCL.930.FI.

AIR EXERCISES

(a) The air exercises are similar to those used for the training of SPL or BPL but with additional items designed to cover the needs of a flight instructor.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment;

(6) Applicability of the exercises to the aircraft type.

(c) At the discretion of the instructors some of the exercises may be combined whereas some other exercises may be done in several flights.

(d) It follows that student instructors will eventually be faced with similar inter-related factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(e) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted with regard to who is to fly the aircraft and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(f) The five basic components of the briefing will be:

(1) the aim;

(2) the air exercise(s) (what, and how and by whom);

(3) flight briefing;

(4) check of understanding;

(5) airmanship.

PLANNING OF FLIGHT LESSONS

(g) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(h) The student instructor should complete flight training in order to practise the principles of basic instruction at the SPL or BPL level. During this training the student instructor occupies the seat normally occupied by the FI.

(i) The instructor providing this instructor training is normally taking over the role of the student pilot. In the case of the course for the FI(B) an additional person holding a BPL or LAPL(B) licence or a student pilot for these licences may be on board in order to function as a student pilot under the supervision of the instructor.

(j) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

A. SAILPLANES

LONG BRIEFINGS AND AIR EXERCISES

Note: although the fully developed spin in exercise 10 is not required for the LAPL course, it is a requirement for the FI course.

EXERCISE 1: FAMILIARISATION WITH THE SAILPLANE

(a) Objective:

To advise the student instructor on how to familiarise the student with the sailplane which will be used for the training and to test his/her position in the sailplane for comfort, visibility, and ability to use all controls and equipment.

(b) Briefing and exercise:

The student Instructor has to:

(1) present the type of sailplane which will be used;

(2) explain the cockpit layout: instruments and equipment;

(3) explain the flight controls: stick, pedals, airbrakes, flaps, cable release, undercarriage;

(4) check the position of the student on the seat for comfort, visibility, ability to use all controls;

(5) explain the use of the harness;

(6) demonstrate how to adjust the rudder pedal;

(7) explain the differences when occupying the instructor's position;

(8) explain all checklists, drills, controls.

EXERCISE 2: PROCEDURE IN THE EVENT OF EMERGENCIES

(a) Objective:

To advise the student instructor on how to familiarise the student with the use of the parachute and how to explain the bail out procedure in case of emergency.

(b) Briefing and exercise:

The student instructor has to:

(1) explain how to handle the parachute with care (transport, storage and drying after use);

(2) demonstrate the adjustment of the parachute harness;

(3) explain the bail out procedure (especially from a sailplane in unusual attitude);

(4) explain the procedure for landing with a parachute in normal conditions and with a strong wind.

EXERCISE 3: PREPARATION FOR FLIGHT

(a) Objective:

To advise the student instructor on how to explain all the operations to be completed prior to flight. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the need for a pre-flight briefing;

(2) the structure and the content of this briefing;

(3) which documents are required on board;

(4) which equipment are required for a flight;

(5) how to handle the sailplane on the ground, how to move it, how to tow it out and how to park it;

(6) how to do the pre-flight external and internal checks;

(7) the procedure for verifying in-limits mass and balance;

(8) the pre-launch checks (checklist).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the need for a pre-flight briefing;

(2) that the required documents are on board;

(3) that the equipment required for the intended flight is on board;

(4) how to handle the sailplane on the ground, move it to the start position, tow it out and park it;

(5) how to perform a pre-flight external and internal check;

(6) how to verify in-limits mass and balance;

(7) how to adjust harness as well as seat or rudder pedals;

(8) the pre-launch checks;

(9) how to advise the student pilot in performing the pre-flight preparation;

(10) how to analyse and correct pre-flight preparation errors as necessary.

EXERCISE 4: INITIAL AIR EXPERIENCE

(a) Objective:

To advise the student instructor on how to familiarise the student with being in the air, with the area around the airfield, to note his/her reactions in this situation, and to draw his/her attention to safety and look-out procedures.

(b) Briefing:

The student instructor has to explain:

(1) the area around the airfield;

(2) the need for looking out;

(3) the change of aircraft control.

(c) Air exercise:

The student instructor has to:

(1) show the noteworthy references on the ground;

(2) analyse the reactions of the student;

(3) check that the student looks out (safety).

EXERCISE 5: PRIMARY EFECTS OF CONTROLS

(a) Objective:

To advise the student instructor on how to:

(1) demonstrate the primary effects of each control with the help of visual references;

(2) train the student pilot to recognise when the sailplane is no longer in a normal attitude along one of the axes and to return to the normal attitude;

(3) train continuous and efficient look-out during these exercises;

(4) analyse and correct errors and student pilot mistakes as necessary.

(b) Briefing:

The student instructor has to explain:

(1) define the axes of a sailplane;

(2) the look-out procedures;

(3) the visual references along each axis;

(4) the primary effects of controls when laterally level;

(5) the relationship between attitude and speed;

(6) the use of flaps;

(7) the use of airbrakes.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the visual references in flight;

(2) the primary effect of the elevator;

(3) the relationship between attitude and speed (inertia);

(4) the primary effect of rudder on the rotation of the sailplane around the vertical axis;

(5) the primary effect of ailerons on banking;

(6) the effect of airbrakes (including changes in pitch when airbrakes are extended or retracted);

(7) the effects of flaps (provided the sailplane has flaps);

(8) the look-out procedures during all the exercises;

(9) how to advise the student pilot to recognise the primary effects of each control;

(10) how to analyse and correct errors as necessary.

EXERCISE 6: CO-ORDINATED ROLLING TO AND FROM MODERATE ANGLES OF BANK

(a) Objective:

To advise the student instructor on secondary effects of controls and on how to teach the student to coordinate ailerons and rudder in order to compensate for the adverse yaw effect. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the secondary effects of controls;

(2) the adverse yaw effect;

(3) how to compensate for the adverse yaw;

(4) the further effect of the rudder (roll).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the adverse yaw effect with a reference on ground;

(2) the further effect of the rudder (roll);

(3) the coordination of ruder and aileron controls to compensate for the adverse yaw effects;

(4) rolling to and from moderate angles of bank (20 to 30 °) and returning to the straight flight;

(5) how to advise the student pilot to coordinate ailerons and rudder;

(6) how to analyse and correct errors as necessary.

EXERCISE 7: STRAIGHT FLYING

(a) Objective:

To advise the student instructor on how to train the student to maintain straight flight with a constant heading without slipping and skidding. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to:

(1) explain how to maintain straight flight;

(2) explain different air speed limitations;

(3) explain the pitch stability of the sailplane;

(4) explain the effect of trimming.

(c) Air exercise:

The instructor student has to demonstrate:

(1) maintaining straight flight;

(2) inherent pitch stability;

(3) the control of the sailplane in pitch, including use of trim with visual references and speed;

(4) how to perform the instrument monitoring;

(5) the control of level attitude with visual references;

(6) the control of the heading with a visual reference on the ground;

(7) the look-out procedures during all the exercises;

(8) how to advise the student pilot to maintain straight flight;

(9) how to analyse and correct errors as necessary.

EXERCISE 8: TURNING

(a) Objective:

To advise the student instructor on how to teach students to fly turns and circles with a moderate constant bank of about 30 ° with constant attitude (speed) and coordinated flight. Furthermore**,** the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the forces on the sailplane during a turn;

(2) the need to look out before turning;

(3) the sequences of a turn (entry, stabilizing and exiting);

(4) the common faults during a turn;

(5) how to turn on to selected headings, use of compass;

(6) the use of instruments (ball indicator or slip string) for precision.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the look-out procedure before turning;

(2) entering a turn (correction of adverse yaw);

(3) the stabilisation of a turn (keeping the attitude and compensating the induced roll);

(4) the exit from a turn;

(5) the most common faults in a turn;

(6) turns on to selected headings (use landmarks as reference);

(7) use of instruments (ball indicator or slip string) for precision:

(8) how to advise the student pilot to fly a turn or circle with a moderate bank;

(9) how to analyse and correct errors as necessary.

EXERCISE 9a: SLOW FLIGHT

(a) Objective:

To advise the student instructor on how to improve the student's ability to recognise inadvertent flight at critically low speeds (high angle of attack) and to provide practice in maintaining the sailplane in balance while returning to normal attitude (speed). Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the characteristics of slow flight;

(2) the risks of stalling.

(c) Air Exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft before starting the exercise.

The student instructor has to demonstrate:

(1) a controlled flight down to critically high angle of attack (slow air speed), and draw the attention of the student to the nose up attitude, reduction of noise, reduction of speed;

(2) a return to the normal attitude (speed);

(3) how to advise the student pilot to recognise inadvertent flight at critically low speeds;

(4) how to provide practice in maintaining the sailplane in balance while returning to normal attitude;

(5) how to analyse and correct errors as necessary.

EXERCISE 9b: STALLING

(a) Objective:

To advise the student Instructor on how to improve the student's ability to recognize a stall and to recover from it. This includes stall from a level flight and stalls when a wing drops. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the mechanism of a stall;

(2) the effectiveness of the controls at the stall;

(3) pre-stall symptoms, recognition and recovery;

(4) factors affecting the stall (importance of the angle of attack and high speed stall);

(5) effect of flaps if any on the sailplane;

(6) the effects of unbalance at the stall safety checks;

(7) stall symptoms, recognition and recovery;

(8) recovery when a wing drops;

approach to stall in the approach and in the landing configurations: recognition and recovery from accelerated stalls.

(c) Air Exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to demonstrate:

(1) stall from a level flight;

(2) pre-stall symptoms, recognition and recovery;

(3) stall symptoms, recognition and recovery;

(4) recovery when a wing drops;

(5) approach to stall in the approach and in the landing configurations;

(6) recognition and recovery from accelerated stalls;

(7) stalling and recovery at the incipient stage with 'instructor induced' distractions;

(8) how to improve the student pilot's ability to recognise a stall and to recover from it;

(9) how to analyse and correct errors as necessary.

Note: consideration is to be given to manoeuvre limitations and references to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance limitations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are also covered in the next exercise.

EXERCISE 10a: SPIN RECOGNITION AND AVOIDANCE

(a) Objective:

To advise the student Instructor on how to improve the student's ability to recognize a spin at the incipient stage and to recover from it. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) why a sailplane spins;

(2) how to recognise the symptoms of a spin (not to be confused with spiral dive);

(3) what are the parameters influencing the spin;

(4) how to recover from a spin.

(c) Air exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to:

(1) demonstrate stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45 °);

(2) make sure that the student recognises the spin entry;

(3) make sure that the student pilot is able to recover from the spin;

(4) check if the student still reacts properly if the instructor induces distractions during the spin entry;

(5) demonstrate how to analyse and correct errors as necessary.

Note: consideration of manoeuvre limitations and the need to refer to the sailplane manual and mass and balance calculations.

EXERCISE 10b: DEVELOPED SPINS: ENTRY AND RECOVERY

(a) Objective:

To advise the student instructor on how to recognize a developed spin and to recover from it. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the spin entry;

(2) the symptoms of a real spin and the recognition and identification of spin direction;

(3) the spin recovery;

(4) use of controls;

(5) effects of flaps (flap restriction applicable to type);

(6) the effect of the CG upon spinning characteristics;

(7) the spinning from various flight attitudes;

(8) the sailplane limitations;

(9) safety checks;

(10) common errors during recovery.

(c) Air exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to demonstrate:

(1) safety checks;

(2) the spin entry;

(3) the recognition and identification of the spin direction;

(4) the spin recovery (reference to flight manual);

(5) the use of controls;

(6) the effects of flaps (restrictions applicable to sailplane type);

(7) spinning and recovery from various flight attitudes;

(8) how to improve the student pilot's ability to recognise a spin and how to recover from it;

(9) how to analyse and correct errors as necessary.

EXERCISE 11: TAKE OFF OR LAUNCH METHODS

Note: the student instructor has to teach at least one of the following launch methods: winch launch, aero tow, self-launch. At least three launch failure exercises should be completed. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

EXERCISE 11a: WINCH LAUNCH

(a) Objective:

To advise the student instructor on how to teach winch launches and on how to make sure that their student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the signals or communication before and during launch;

(2) the use of the launching equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for crosswind take-off;

(6) the optimum profile of winch launch and limitations;

(7) the launch failure procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of the launching equipment;

(2) the pre-take-off checks;

(3) the into wind take-off;

(4) the crosswind take-off;

(5) the optimum profile of winch launch and limitations;

(6) the procedure in case of cable break or aborted launch, launch failure procedures;

(7) how to teach the student pilot to perform safe winch launches;

(8) how to teach the student pilot to manage an aborted launch (different altitudes);

(9) how to analyse and correct errors as necessary.

EXERCISE 11b: AERO TOW

(a) Objective:

To advise the student instructor on how to teach aero towing and on how to make sure that their student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the signals or communication before and during launch;

(2) the use of the launch equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for crosswind take-off;

(6) the procedure on tow: straight flight, turning and slip stream;

(7) the recovery from out-of-position on tow;

(8) the procedures in case of launch failure and abandonment;

(9) the descending procedure on tow (towing aircraft and sailplane);

(10) the reasons for launch failures and abandonment or procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the signals before and during launch;

(2) the use of the launch equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for a crosswind take-off;

(6) the procedures on tow: straight flight, turning and slip stream;

(7) the recovery from out-of-position on tow;

(8) the procedure in case of launch failure and abandonment;

(9) the descending procedure on tow;

(10) how to teach the student pilot to perform safe aero tow launches;

(11) how to teach the student pilot to manage an aborted launch;

(12) how to analyse and correct errors as necessary.

EXERCISE 11c: SELF LAUNCH

(a) Objective:

To advise the student instructor on how to teach launching with a self launching sailplane and on how to make sure that his/her student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the engine extending and retraction procedures;

(2) the engine starting and safety precautions;

(3) the pre-take-off checks;

(4) the noise abatement procedures;

(5) the checks during and after take-off;

(6) the into wind take-off;

(7) the crosswind take-off;

(8) the procedure in case of power failure;

(9) the procedure in case of abandoned take-off;

(10) the maximum performance (short field and obstacle clearance) take-off;

(11) the short take-off and soft field procedure or techniques and performance calculations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the engine extending and retraction procedures;

(2) the engine starting and safety precautions;

(3) the pre-take-off checks;

(4) the noise abatement procedures;

(5) the checks during and after take off;

(6) the into wind take-off;

(7) the crosswind take-off;

(8) the power failures and procedures;

(9) the procedure in case of abandoned take-off;

(10) the maximum performance (short field and obstacle clearance) take-off;

(11) the short take-off and soft field procedure or techniques and performance calculations;

(12) how to teach the student pilot to perform safe self launches;

(13) how to teach the student pilot to manage an aborted launch (different altitudes);

(14) how to analyse and correct errors as necessary.

EXERCISE 12: CIRCUIT APPROACH AND LANDING

(a) Objective:

To advise the student instructor on how to teach their students to fly a safe circuit approach and to land the sailplane. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the procedures for rejoining the circuit;

(2) the procedures for collision avoidance and the lookout techniques;

(3) the pre-landing check;

(4) the normal circuit procedures, downwind, base leg;

(5) the effect of wind on approach and touchdown speeds ;

(6) the visualisation of a reference point;

(7) the approach control and use of airbrakes;

(8) the use of flaps (if applicable);

(9) the procedures for normal and crosswind approach and landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the procedures for rejoining the circuit;

(2) the procedures for collision avoidance and the look-out techniques;

(3) the pre-landing check;

(4) the standard circuit and contingency planning (for example running out of height);

(5) the effect of wind on approach and touchdown speeds;

(6) the visualisation of an aiming point;

(7) the approach control and use of airbrakes;

(8) the use of flaps (if applicable);

(9) the procedures for normal and crosswind approaches and landings;

(10) how to teach the student pilot to fly a safe circuit approach;

(11) how to improve the student pilot's ability to perform a safe landing;

(12) how to analyse and correct errors as necessary.

EXERCISE 13: FIRST SOLO

(a) Objective:

To advise the student instructor on how to prepare their students for the first solo flight.

(b) Briefing:

The student instructor has to explain:

(1) the limitations of the flight (awareness of local area and restrictions);

(2) the use of required equipment.

(c) Air exercise:

The student instructor has to;

(1) check with another or more senior instructor if the student can fly solo;

(2) monitor the flight;

(3) debrief the flight with the student.

EXERCISE 14 : ADVANCED TURNING

(a) Objective:

To advise the student instructor on how to fly steep turns or circles (45 ° banking) at constant attitude (speed) and with the yaw string centred. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain;

(1) the relationship between banking and speed;

(2) how to master steep turns or circles;

(3) the unusual attitudes which can occur (stalling or spinning and spiral dive);

(4) how to recover from these unusual attitudes.

(c) Air exercise:

The student has to demonstrate:

(1) steep turns (45 °) at constant speed and with the yaw string centred;

(2) common errors (slipping and skidding);

(3) unusual attitudes and how to recover from them;

(4) how to teach the student pilot to fly steep turns or circles;

(5) how to analyse and correct errors as necessary.

EXERCISE 15: SOARING TECHNIQUES

Note: if the weather conditions during the instructor training do not allow the practical training of soaring techniques, all items of the air exercises have to be discussed and explained during a long briefing exercise only.

EXERCISE 15a: THERMALLING

(a) Objective:

To advise the student instructor on how to teach their students to recognise and detect thermals, on how to join a thermal and on how to look out, in order to avoid mid-air collisions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain;

(1) the look-out procedures;

(2) the detection and recognition of thermals;

(3) the use of audio soaring instruments;

(4) the procedure for joining a thermal and giving way;

(5) how to fly in close proximity to other sailplanes;

(6) how to centre in thermals;

(7) how to leave thermals.

(c) Air exercise:

The student instructor has to demonstrate;

(1) the look-out procedures;

(2) the detection and recognition of thermals;

(3) the use of audio soaring instruments;

(4) the procedure for joining a thermal and giving way;

(5) the procedure for flying in close proximity to other sailplanes;

(6) the centering in thermals;

(7) the procedure for leaving thermals;

(8) how to improve the student pilot's ability to recognise and detect thermals;

(9) how to improve the student pilot's ability to join a thermal and how to look out;

(10) how to analyse and correct errors as necessary.

EXERCISE 15b: RIDGE FLYING

(a) Objective:

To advise the student instructor on how to teach his/her students to fly safely on ridges, to control their speed, and to apply the rules in order to avoid mid-air collisions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the look-out procedures;

(2) the ridge flying rules;

(3) the recognition of optimum flight path;

(4) speed control.

(c) Air exercise: (if applicable during training and, if possible, at training site)

The student instructor has to demonstrate:

(1) the look-out procedures;

(2) the practical application of ridge flying rules;

(3) the recognition of optimum flight path;

(4) speed control;

(5) how to teach the student pilot to fly safely on ridges;

(6) how to analyse and correct errors as necessary.

EXERCISE 15c: WAVE FLYING

(a) Objective:

To advise the student instructor on how to introduce students to wave flying and to teach them to fly safely at high altitude. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the look-out procedures;

(2) the techniques to be used to accede to a wave;

(3) the speed limitations with increasing height;

(4) the risks of hypoxia and the use of oxygen.

(c) Air exercise: (if applicable during training and if possible at training site)

The student instructor has to demonstrate:

(1) the look-out procedures;

(2) the wave access techniques;

(3) the speed limitations with increasing height;

(4) the use of oxygen (if available);

(5) how to improve the student pilot's ability to recognise and detect waves;

(6) how to teach the student pilot to fly safely in a wave;

(7) how to analyse and correct errors as necessary.

EXERCISE 16: OUT-LANDINGS

Note: if the weather conditions during the instructor training do not allow the practical training of out-landing procedures (a touring motor glider may be used) all items of the air exercise have to be discussed and explained during a long briefing exercise only. Instructors may only teach the safe out-landing exercise after they have demonstrated the practical ability to do so.

(a) Objective:

To advise the student instructor on how to teach students to select an out-landing field, to fly the circuit and how to master the unusual landing situation. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the gliding range at max L/D;

(2) the engine re-start procedures (only for self-launching and self-sustaining sailplanes);

(3) the selection of a landing area;

(4) the circuit judgement and key positions;

(5) the circuit and approach procedures;

(6) the actions to be done after landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) precision landings on the airfield;

(2) the gliding range;

(3) the procedures for joining, arrival and circuit at a remote aerodrome;

(4) the selection of an out-landing area;

(5) the procedures for circuit and approach on an out-landing field;

(6) the actions to be done after landing;

The student instructor also has to be trained:

(7) how to advise the student pilot to do perform a safe out-landing;

(8) how to master an unusual landing situation;

(9) how to analyse and correct errors as necessary.

EXERCISE 17: CROSS COUNTRY FLYING

Note: if the weather conditions during the instructor training do not allow a cross country training flight the items of the air exercise have to be discussed and explained during a long briefing exercise only.

EXERCISE 17a: FLIGHT PLANNING

(a) Objective:

To advise the student instructor on how plan and prepare a cross-country flight.

(b) Briefing:

The student instructor has to explain:

(1) the weather forecast and current situation;

(2) the selection of the amount of water to be carried as a function of the weather forecast;

(3) the method for selecting a task, taking into account the average speed to be expected;

(4) the map selection and preparation;

(5) the NOTAMs and airspace considerations;

(6) the radio frequencies (if applicable);

(7) the pre-flight administrative procedures;

(8) the procedure for filing a flight plan where required;

(9) alternate aerodromes and landing areas.

EXERCISE 17b: IN-FLIGHT NAVIGATION

(a) Objective:

To advise the student instructor on how to teach performing a cross-country flight.

(b) Briefing:

The student instructor has to explain:

(1) how to maintain track and re-route if necessary;

(2) the altimeter settings;

(3) the use of radio and phraseology;

(4) the in-flight planning;

(5) the procedures for transiting regulated airspace or ATC liaison where required;

(6) the procedure in case of uncertainty of position;

(7) the procedure in case of becoming lost;

(c) Air exercise:

The student instructor has to demonstrate:

(1) maintaining track and re-routing if necessary;

(2) altimeter settings;

(3) the use of radio and phraseology;

(4) in-flight planning;

(5) procedures for transiting regulated airspace or ATC liaison where required;

(6) uncertainty of position procedure;

(7) lost procedure;

(8) use of additional equipment where required;

(9) joining, arrival and circuit procedures at remote aerodrome;

(10) how to teach the student pilot to perform a cross-country flight;

(11) how to analyse and correct errors as necessary.

EXERCISE 17c: CROSS-COUNTRY SOARING TECHNIQUES

(a) Objective:

To advise the student instructor on the techniques for an efficient cross country flight.

(b) Briefing:

The student instructor has to explain:

(1) the speed to fly at maximal L/D ratio;

(2) the speed to fly to maximise the cruise speed (Mc Cready theory);

(3) how to select the optimal track (efficient use of cloud streets etc.);

(4) how to calculate the final glide;

(5) how to perform a safe out-landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a cross-country flight;

(2) the selection of the optimal track (efficient use of cloud streets, etc) ;

(3) the use of the Mc Cready ring;

(4) use of final glide computers;

(5) how to reduce risk and to react to potential dangers;

(6) how to plan and perform an out-landing;

(7) how to teach the student pilot techniques for an efficient cross-country flight;

(8) how to analyse and correct errors as necessary.

B. BALLOONS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: FAMILIARISATION WITH THE BALLOON

(a) Objective:

To advise the student Instructor on how to familiarise the student with the balloon which will be used for the training and to test his position in the basket for comfort, visibility, and ability to use all controls and equipment. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing and exercise:

The student instructor has to:

(1) present the type of balloon which will be used;

(2) explain the characteristics of the balloon;

(3) explain the components, instruments and equipment;

(4) explain the re-fuelling procedures (in the case of hot air balloons);

(5) to familiarise the student with the balloon controls;

(6) explain the differences when occupying the instructor’s position;

(7) explain all checklists, drills and controls.

EXERCISE 2: PREPARATION FOR FLIGHT

(a) Objective:

To advise the student instructor on how to explain all the operations and necessary preparation to be completed before the flight. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing

The student instructor has to explain:

(1) the need for a pre-flight briefing;

(2) the structure and the content of this briefing;

(3) which documents are required on board;

(4) which equipment are required for a flight;

(5) the use of weather forecasts or actuals;

(6) the flight planning with particular regard to NOTAMs, airspace structure, sensitive areas, expected track and distance, pre-flight picture and possible landing fields;

(7) the use of load calculation chart;

(8) the selection of launch field with particular regard to permission, behaviour and adjacent fields.

(c) Air exercise:

The student instructor has to prepare and give a pre-flight briefing.

The student instructor has to demonstrate:

(1) that the required documents are on board;

(2) that the equipment required for the intended flight is on board;

(3) how to advice the student to do the pre-planning procedures for each flight;

(4) how to perform a pre-launch check;

(5) how to select a launch field with particular regard to permission, behaviour and adjacent fields;

(6) how to teach the student pilot to perform the preparation to be completed prior to flight;

(7) how to analyse and correct errors of the student pilot as necessary.

EXERCISE 3: CREW AND PASSENGER BRIEFING

(a) Objective:

To advise the student instructor on how to explain all the importance of correct clothing for pilot, passengers and crew and how to perform the briefing of ground- and retrieve crew and the briefing of passengers. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the correct clothing for passengers and crew;

(2) the briefings for ground- and retrieve crew and passengers.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to advise the passengers and crew about the correct clothing;

(2) the briefing of ground- and retrieve crew;

(3) the briefing of passengers;

(4) how to familiarise the student pilot with the different type of briefings;

(5) how to analyse and correct errors of the student pilot.

EXERCISE 4: ASSEMBLY AND LAYOUT

(a) Objective:

To advise the student instructor on how to familiarise the student pilot with the control of the crowd and how to perform the securing of launch site. Furthermore the student instructor has to demonstrate how to familiarise the student pilot with the correct rigging of envelope and basket, the burner test procedure (hot air balloons) and the pre-inflation checks. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the control of the crowd;

(2) the securing of the launch site;

(3) the correct rigging procedure;

(4) the use of the restraint line;

(5) the pre-inflation checks.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to control the crowd and securing of launch site;

(2) the correct rigging of envelope and basket;

(3) the correct use of the restraint line;

(4) the burner test procedure (hot air balloons);

(5) the pre-inflation checks;

(6) how to teach the student pilot to perform the correct rigging;

(7) how to analyse and correct assembly errors of the student pilot as necessary.

EXERCISE 5: INFLATION

(a) Objective:

To advise the student instructor on how to familiarise the student pilot with the different phases of the inflation procedure, the use of restraint line and inflation fan (hot air balloons) and the avoidance of electrostatic discharge (gas balloons). Furthermore**,** the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the different phases of the inflation procedure;

(2) the crowd control and securing procedures during inflation;

(3) the use of the inflation fan (hot air balloons);

(4) how to avoid electronic discharge (gas balloons).

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to control of crowd and securing of launch site during inflation procedure;

(2) the cold inflation procedure and use of restraint line and inflation fan (hot air balloons);

(3) the hot inflation procedure (hot air balloons);

(4) the avoidance of electrostatic discharge (gas balloons);

(5) the inflation procedure (gas balloons);

(6) how to teach the student pilot to perform the inflation procedures;

(7) how to analyse and correct errors of the student pilot during the inflation procedure as necessary.

EXERCISE 6: TAKE OFF IN DIFFERENT WIND CONDITIONS

(a) Objective:

To advise the student instructor how to explain the pre take-off checks and briefings, the preparation for controlled climb and the use of restraint equipment. Furthermore the student instructor should be able to demonstrate the assessment of wind and obstacles, the preparation for false lift and the take off techniques in different wind conditions. In addition to this the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre take-off checks and briefings;

(2) the preparation for controlled climb;

(3) the 'hands off and hands on' procedure for ground crew;

(4) the assessment of lift;

(5) the use of the restraint equipment ;

(6) the assessment of wind and obstacles;

(7) the preparation for false lift;

(8) the take off techniques from sheltered and non sheltered launch fields.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to perform the pre take-off checks and briefings;

(2) how to prepare for controlled climb;

(3) how to perform the 'hands off and hands on' procedure for ground crew;

(4) how to perform the assessment of lift without endangering the ground crew;

(5) how to use the restraint equipment;

(6) how to perform the assessment of wind and obstacles;

(7) how to prepare for false lift;

(8) how to teach the student pilot the correct take off techniques from sheltered and non sheltered launch fields;

(9) how to analyse and correct errors of the student pilot as necessary.

EXERCISE 7: CLIMB TO LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate the climb to flight level. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the climbing with a predetermined rate of climb;

(2) the effect on envelope temperature (hot air balloons);

(3) the maximum rate of climb according to manufacturer's flight manual;

(4) how to level off at selected altitude.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to climb with a predetermined rate of climb;

(2) how to perform look out techniques;

(3) the effect on envelope temperature (hot air balloons);

(4) the maximum rate of climb according to manufacturer's flight manual;

(5) the levelling off techniques at selected altitude;

(6) how to advise the student pilot to perform the climb to level flight;

(7) how to analyse and correct faults or errors of the student pilot during the climb.

EXERCISE 8: LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate level flight. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) how to maintain level flight by use of instruments;

(2) how to maintain level flight by use of visual references;

(3) how to maintain level flight by use of all available means;

(4) the use of parachute;

(5) the use of turning vents if installed (hot air balloons).

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to maintain level flight by use of instruments;

(2) how to maintain level flight by use of visual references;

(3) how to maintain level flight by use of all available means;

(4) the use of parachute;

(5) the use of turning vents if installed (hot air balloons);

(6) how to advise the student pilot to perform the level flight;

(7) how to analyse and correct faults or errors of the student pilot during the level flight.

EXERCISE 9: DESCENT TO LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate the descent to a certain flight level. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) how to descent with a predetermined rate of descent;

(2) a fast descent;

(3) the maximum rate of descent according to manufacturer's flight manual;

(4) the use of parachute;

(5) a parachute stall and cold descent (hot air balloons);

(6) the levelling off technique at selected altitude.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a descent with a predetermined rate of descent;

(2) how to perform look out techniques;

(3) a fast descent;

(4) the maximum rate of descent according to manufacturer's flight manual;

(5) the use of parachute;

(6) how to level off at selected altitudes;

(7) how to advise the student pilot to perform a descent to a certain flight level;

(8) how to analyse and correct faults or errors of the student pilot during the descent.

EXERCISE 10: EMERGENCIES

(a) Objective:

To advise the student instructor on how to explain and demonstrate the different emergency situations and how to react. Furthermore the student instructor should learn how to identify student errors during the simulated emergency exercises and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pilot light failure (hot air balloons);

(2) burner failures, valve leaks, flame out and re-light (hot air balloons);

(3) gas leaks;

(4) closed appendix during take-off and climb (gas balloons);

(5) the envelope over temperature (hot air balloons);

(6) envelope damage in flight;

(7) the parachute or rapid deflation system failure;

(8) fire on ground and in the air;

(9) how to avoid an obstacle contact including contact with electrical power lines;

(10) escape drills, location and use of emergency equipment.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a pilot light failure (hot air balloons);

(2) a burner failure, valve leaks, flame out and re-light (hot air balloons);

(3) gas leaks;

(4) a closed appendix during take-off and climb (gas balloons);

(5) envelope over temperature (hot air balloons);

(6) envelope damage in flight;

(7) parachute or rapid deflation system failure;

(8) a fire on ground and in the air;

(9) the escape drills, location and use of emergency equipment;

(10) how to advise the student pilot in performing the different emergency drills;

(11) how to analyse and correct faults or errors of the student pilot.

EXERCISE 11: NAVIGATION

(a) Objective:

To advise the student instructor on how to explain and demonstrate the advanced navigational flight preparation. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the maps selection;

(2) the plotting of the expected track;

(3) the marking of positions and time;

(4) the calculation of distance and speed;

(5) the calculation of fuel consumption (hot air balloons);

(6) the calculation of ballast consumption (gas balloons);

(7) the ceiling limitations (ATC or weather);

(8) how to plan ahead;

(9) the monitoring of weather development;

(10) the monitoring of fuel or ballast consumption;

(11) ATC liaison (if applicable);

(12) the communication with retrieve crew;

(13) the use of GNSS.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of selected maps;

(2) the plotting of the expected track;

(3) the marking of positions and time;

(4) how to monitor of distance and speed;

(5) how to monitor the fuel or ballast consumption;

(6) the observance of ceiling limitations (ATC or weather);

(7) the planning ahead;

(8) the monitoring of weather development;

(9) the monitoring of envelope temperature (hot air balloons);

(10) ATC liaison (if applicable);

(11) communication with retrieve crew;

(12) use of GNSS;

(13) how to advise the student pilot in performing the navigational preparation;

(14) how to advise the student pilot in performing the different navigational in-flight tasks;

(15) how to analyse and correct faults or errors of the student pilot.

EXERCISE 12a: FUEL MANAGEMENT HOT AIR BALLOONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate the fuel management techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the cylinder arrangement and the burner systems;

(2) the function of the pilot light supply (vapour or liquid);

(3) the use of master cylinders (if applicable);

(4) the fuel requirement and expected fuel consumption;

(5) the fuel state and pressure;

(6) the minimum fuel reserves;

(7) cylinder contents gauge and change procedure;

(8) the use of cylinder manifolds.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the cylinder arrangement and burner systems;

(2) the pilot light supply (vapour or liquid);

(3) the use of master cylinders (if applicable);

(4) how to monitor of fuel requirement and expected fuel consumption;

(5) the monitoring of fuel state and pressure;

(6) the monitoring of fuel reserves;

(7) the use of cylinder contents gauge and change procedure;

(8) the use of cylinder manifolds;

(9) how to advise the student pilot to perform the fuel management;

(10) how to analyse and correct faults or errors of the student pilot.

EXERCISE 12b: BALLAST MANAGEMENT GAS BALLOONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate the ballast management. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the minimum ballast;

(2) the arrangement and securing of ballast;

(3) the ballast requirement and expected ballast consumption;

(4) the ballast reserves.

(c) Air exercise:

The student instructor also has to demonstrate:

(1) the arrangement of minimum ballast;

(2) the arrangement and securing of ballast;

(3) the ballast requirement calculation and expected ballast consumption;

(4) how to secure ballast reserves;

(5) how to advise the student pilot to perform the ballast management;

(6) how to analyse and correct faults or errors of the student pilot.

EXERCISE 13: APPROACH FROM LOW LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the approach from level. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre landing checks;

(2) passenger pre-landing briefing;

(3) the selection of field;

(4) the use of burner and parachute (hot air balloons);

(5) the use of ballast or parachute and valve (gas balloons);

(6) the use of trail rope (if applicable) (gas balloons);

(7) the look-out;

(8) missed approach and fly on procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of the pre landing checks;

(2) the selection of fields;

(3) the use of burner and parachute (hot air balloons);

(4) the use of ballast or parachute and valve (gas balloons);

(5) the use of trail rope (if applicable) (gas balloons);

(6) the look out procedures and how to avoid possible distractions;

(7) the missed approach and fly on techniques;

(8) how to advise the student pilot to perform an approach from low level;

(9) how to analyse and correct faults or errors of the student pilot.

EXERCISE 14: APPROACH FROM HIGH LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the approach from high level. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre-landing checks;

(2) passenger pre-landing briefing;

(3) the selection of field;

(4) the rate of descent;

(5) the use of burner and parachute (hot air balloons);

(6) the use of ballast and parachute (gas balloons);

(7) the use of trail rope (if applicable) (gas balloons);

(8) the look-out;

(9) the missed approach and fly on procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the pre-landing checks;

(2) the selection of field;

(3) the rate of descent;

(4) the use of burner and parachute (hot air balloons);

(5) the use of ballast and parachute (gas balloons);

(6) the use of trail rope (if applicable) (gas balloons);

(7) the look out procedures and how to avoid potential distraction;

(8) the missed approach and fly on techniques;

(9) how to advise the student pilot to perform an approach from a higher level;

(10) how to analyse and correct faults or errors of the student pilot.

EXERCISE 15: OPERATING AT LOW LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the operation at a low height. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the use of burner and parachute (hot air balloons);

(2) the use of ballast and parachute (gas balloons);

(3) the look out;

(4) how to avoid a contact with low level obstacles;

(5) how to avoid sensitive areas (for example nature protection areas);

(6) landowner relations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of burner and parachute (hot air balloons);

(2) the use of ballast and parachute (gas balloons);

(3) the look out procedures and how to avoid potential distraction;

(4) how to avoid low level obstacles;

(5) good landowner relations;

(6) how to advise the student pilot to operate the balloon at a low level;

(7) how to analyse and correct faults or errors of the student pilot.

EXERCISE 16: LANDING IN DIFFERENT WIND CONDITIONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate landings in different wind conditions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the correct actions for turbulences during the approach or landing;

(2) the passenger pre-landing briefing;

(3) the use of burner and pilot lights (hot air balloons);

(4) the use of ballast, parachute, valve and rip panel (gas balloons);

(5) the use of parachute and turning vents (if applicable);

(6) the look out;

(7) the landing, dragging and deflation;

(8) landowner relations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the pre-landing checks;

(2) the passenger briefing;

(3) the selection of field;

(4) the effect of turbulence;

(5) the use of burner and pilot lights (hot air balloons);

(6) the use of ballast, parachute, valve and rip panel (gas balloons);

(7) the use of parachute and turning vents (if applicable);

(8) the look out procedures and how to avoid potential distraction;

(9) the landing, dragging and deflation procedures;

(11) how to advise the student pilot to perform a safe landing in different wind conditions;

(12) how to analyse and correct faults or errors of the student pilot.

EXERCISE 17: FIRST SOLO

(a) Objective:

To advise the student instructor on how to prepare their students for the first solo flight.

(b) Briefing:

The student instructor has to explain:

(1) the limitations of the flight;

(2) the use of required equipment.

(c) Air exercise:

The student instructor has to:

(1) check with another or more senior instructor if the student can fly solo;

(2) monitor the pre-flight preparation;

(3) brief the student (expected flight time or emergency actions);

(4) monitor the flight as far as possible;

(5) debrief the flight with the student.

EXERCISE 18: TETHERED FLIGHT HOT AIR BALLOONS (if tethered flight instructional qualification is required)

(a) Objective:

To advise the student instructor on how to explain and demonstrate the tethering techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the ground preparations;

(2) the weather suitability;

(3) the tethering techniques and equipment;

(4) the maximum all-up-weight limitation;

(5) the crowd control;

(6) the pre take-off checks and briefings;

(7) the heating for controlled lift off;

(8) the ‘hands off and hands on’ procedure for ground crew;

(9) the assessment of wind and obstacles;

(10) the controlled climb to a pre-defined altitude (at least 60 ft).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the ground preparations;

(2) the tethering techniques;

(3) the reason for maximum all-up-weight limitation;

(4) how to perform the crowd control;

(5) the pre take-off checks and briefings;

(6) the heating for controlled lift off;

(7) the 'hands off and hands on' procedure for ground crew;

(8) the assessment of wind and obstacles;

(9) the controlled climb;

(10) the landing techniques;

(11) how to advise the student pilot to perform a tethered flight;

(12) how to analyse and correct faults or errors of the student pilot.

EXERCISE 19: NIGHT FLYING (if night instructional qualification required)

(a) Objective:

To advise the student instructor on how to explain and demonstrate the night flying techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the medical or physiological aspects of night vision;

(2) the use of lights for assembly, layout and inflation;

(3) the requirement for torch to be carried, (pre-flight inspection, etc.);

(4) the use of the external- and instrument lights;

(5) the night take-off procedure;

(6) the checklist procedures at night;

(7) the emergency procedures at night;

(8) the navigation principles at night;

(9) map marking for night use (highlighting built up or lit areas with thicker lines, etc.).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of lights for assembly, layout and inflation;

(2) the use of torch for pre-flight inspection;

(3) the use of external- and instrument lights;

(4) the night take-off procedure;

(5) how to perform the checklist procedures at night;

(6) simulated night emergency procedures;

(7) night cross country techniques, as appropriate;

(8) how to advise the student pilot to perform a flight at night;

(9) how to analyse and correct faults or errors of the student pilot.

FCL.940.FI FI — Revalidation and renewal

(a) For revalidation of an FI certificate, the holder shall fulfil 2 of the following 3 requirements:

(1) complete:

(i) in the case of an FI(A) and (H), at least 50 hours of flight instruction in the appropriate aircraft category during the period of validity of the certificate as, FI, TRI, CRI, IRI, MI or examiner. If the privileges to instruct for the IR are to be revalidated, 10 of these hours shall be flight instruction for an IR and shall have been completed within the last 12 months preceding the expiry date of the FI certificate;

(ii) in the case of an FI(As), at least 20 hours of flight instruction in airships as FI, IRI or as examiner during the period of validity of the certificate. If the privileges to instruct for the IR are to be revalidated, 10 of these hours shall be flight instruction for an IR and shall have been completed within the last 12 months preceding the expiry date of the FI certificate;

(iii) in the case of an FI(S), at least 30 hours or 60 take-offs of flight instruction in sailplanes, powered sailplanes or TMG as, FI or as examiner during the period of validity of the certificate;

(iv) in the case of an FI(B), at least 6 hours of flight instruction in balloons as, FI or as examiner during the period of validity of the certificate;

(2) attend an instructor refresher seminar, within the validity period of the FI certificate;

(3) pass an assessment of competence in accordance with FCL.935, within the 12 months preceding the expiry date of the FI certificate.

(b) For the at least each alternate subsequent revalidation in the case of FI(A) or FI(H), or each third revalidation, in the case of FI(As), (S) and (B), the holder shall have to pass an assessment of competence in accordance with FCL.935.

(c) Renewal. If the FI certificate has lapsed, the applicant shall, within a period of 12 months before renewal:

(1) attend an instructor refresher seminar;

(2) pass an assessment of competence in accordance with FCL.935.

AMC1 FCL.940.FI(a)(2) FI — Revalidation and renewal

FI OR IRI REFRESHER SEMINAR

(a) FI or IRI refresher seminars made available in Member States should have due regard to geographical location, numbers attending, and periodicity throughout the territory of the Member State concerned.

(b) Such seminars should run for at least 2 days, and attendance from participants will be required for the whole duration of the seminar including breakout groups and workshops. Different aspects, such as inclusion of participants holding certificates in other categories of aircraft should be considered.

(c) Some experienced FIs or IRIs currently involved with flying training and with a practical understanding of the revalidation requirements and current instructional techniques should be included as speakers at these seminars.

(d) The attendance form will be completed and signed by the organiser of the seminar as approved by the competent authority, following attendance and satisfactory participation by the FI or IRI.

(e) The content of the FI or IRI refresher seminar should be selected from the following:

(1) new or current rules or regulations, with emphasis on knowledge of Part-FCL and operational requirements;

(2) teaching and learning;

(3) instructional techniques;

(4) the role of the instructor;

(5) national regulations (as applicable);

(6) human factors;

(7) flight safety, incident and accident prevention;

(8) airmanship;

(9) legal aspects and enforcement procedures;

(10) navigational skills including new or current radio navigation aids;

(11) teaching instrument flying;

(12) weather related topics including methods of distribution.

(13) any additional topic selected by the competent authority.

(f) Formal sessions should allow for a presentation time of 45 minutes, with 15 minutes for questions. The use of visual aids is recommended, with interactive video and other teaching aids (where available) for breakout groups and workshops.

GM1 FCL.940.FI(a)(2) FI — Revalidation and renewal

FI CERTIFICATE: REVALIDATION AND RENEWAL FORM

A. AEROPLANES

INSTRUCTIONAL FLYING EXPERIENCE				
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.				
SINGLE-ENGINE		MULTI-ENGINE		INSTRUMENT
DAY	NIGHT	DAY	NIGHT	
Total instructional hours (preceding 36 months):				

Total instructional hours (preceding 12 months):		
FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(A) certificate
3	**Seminar particulars:**	
Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		
PROFICIENCY CHECK		
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.		
Flying time:		Aeroplane or FFS used:
Main exercise:		
Name(s) of FIE:		Licence number:
Date and place:		Signature:

B. HELICOPTERS

INSTRUCTIONAL FLYING EXPERIENCE
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.
Instrument:
Total instructional hours (preceding 36 months):
Total instructional hours (preceding 12 months):

FI REFRESHER SEMINAR				
1	**This is to certify that the undersigned attended an FI seminar**			
2	**Attendees personal particulars:**			
Name(s):		Address:		
Licence number:		Expiration date of FI(H) certificate:		
3	**Seminar particulars:**			
Date(s) of seminar:		Place:		
4	**Declaration by the responsible organiser:**			
I certify that the above data are correct and that the FI seminar was carried out.				
Date of approval:		Name(s) of organiser: (capital letters)		
Date and place:		Signature:		
5	**Declaration by the attendee:**			

I confirm the data under 1 through 3	
Attendee's signature:	
PROFICIENCY CHECK	
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.	
Flying time:	Helicopter or FFS used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	
Signature:	

C. AIRSHIPS

INSTRUCTIONAL FLYING EXPERIENCE				
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.				
SINGLE-ENGINE		MULTI-ENGINE		INSTRUMENT
DAY	NIGHT	DAY	NIGHT	
Total instructional hours (preceding 36 months):				
Total instructional hours (preceding 12 months):				

FLIGHT INSTRUCTOR REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(As) certificate:
3	**Seminar particulars:**	

Date(s) of seminar:	Place:	
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:	Name(s) of organiser: (capital letters)	
Date and place:	Signature:	
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		

PROFICIENCY CHECK	
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.	
Flying time:	Airship or FFS used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

D. SAILPLANES INSTRUCTIONAL FLYING EXPERIENCE

INSTRUCTIONAL FLYING EXPERIENCE

Instructors applying for revalidation of the FI certificate should enter the instructional hours and take-offs flown during the preceding 36 months.			
SAILPLANE (hours and take-offs)		TMG (hours and take-offs)	
DAY	NIGHT	DAY	NIGHT
Total instructional hours (preceding 36 months):			
Total instructional hours (preceding 12 months):			
Total amount of take-offs (preceding 36 months):			
Total amount of take-offs (preceding 12 months):			

FI REFRESHER SEMINAR			
1	**This is to certify that the undersigned attended an FI seminar**		
2	**Attendee's personal particulars:**		
Name(s):		Address:	
Licence number:		Expiration date of FI(S) certificate:	
3	**Seminar particulars:**		
Date(s) of seminar:		Place:	
4	**Declaration by the responsible organiser:**		
I certify that the above data are correct and that the FI seminar was carried out.			
Date of approval:		Name(s) of organiser: (capital letters)	
Date and place:		Signature:	
5	**Declaration by the attendee:**		
I confirm the data under 1 through 3			
Attendee's signature:			
PROFICIENCY CHECK			
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.			

Flying time:	Sailplane or TMG used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

E. BALLOONS

INSTRUCTIONAL FLYING EXPERIENCE				
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.				
Balloons (gas)		Balloons (hot-air)		Hot-air airships
DAY	NIGHT	DAY	NIGHT	DAY NIGHT
Total instructional hours (preceding 36 months):				
Total instructional hours (preceding 12 months):				

FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(B) certificate:
3	**Seminar particulars:**	
Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:

5	**Declaration by the attendee:**

I confirm the data under 1 through 3
Attendee's signature:
PROFICIENCY CHECK
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.

Flying time:	Balloon or hot-air airship used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

Go back to Subpart I
Go back to the content

SECTION 4 - Specific requirements for the type rating instructor — TRI

FCL.905.TRI TRI — Privileges and conditions

The privileges of a TRI are to instruct for:

(a) the revalidation and renewal of an EIR or an IR, provided the TRI holds a valid IR;

(b) the issue of a TRI or SFI certificate, provided that the holder has 3 years of experience as a TRI; and

(c) in the case of the TRI for single-pilot aeroplanes:

(1) the issue, revalidation and renewal of type ratings for single-pilot high performance complex aeroplanes when the applicant seeks privileges to operate in single-pilot operations.

The privileges of the TRI(SPA) may be extended to flight instruction for single-pilot high performance complex aeroplanes type ratings in multi- pilot operations, provided that the TRI:

(i) holds an MCCI certificate; or

(ii) holds or has held a TRI certificate for multi-pilot aeroplanes;

(2) the MPL course on the basic phase, provided that he/she has the privileges extended to multi-pilot operations and holds or has held an FI(A) or an IRI(A) certificate;

(d) in the case of the TRI for multi-pilot aeroplanes:

(1) the issue, revalidation and renewal of type ratings for:

(i) multi-pilot aeroplanes;

(ii) single-pilot high performance complex aeroplanes when the applicant seeks privileges to operate in multi-pilot operations;

(2) MCC training;

(3) the MPL course on the basic, intermediate and advanced phases, provided that, for the basic phase, they hold or have held an FI(A) or IRI(A) certificate;

(e) in the case of the TRI for helicopters:

(1) the issue, revalidation and renewal of helicopter type ratings;

(2) MCC training, provided he/she holds a multi-pilot helicopter type rating;

(3) the extension of the single-engine IR(H) to multi-engine IR(H);

(f) in the case of the TRI for powered-lift aircraft:

(1) the issue, revalidation and renewal of powered-lift type ratings;

(2) MCC training.

Go back to Subpart I
Go back to the content

FCL.910.TRI TRI — Restricted privileges

(a) General. If the TRI training is carried out in an FFS only, the privileges of the TRI shall be restricted to training in the FFS.

In this case, the TRI may conduct line flying under supervision, provided that the TRI training course has included additional training for this purpose.

(b) TRI for aeroplanes and for powered-lift aircraft — TRI(A) and TRI(PL). The privileges of a TRI are restricted to the type of aeroplane or powered-lift aircraft in which the training and the assessment of competence was taken. Unless otherwise determined by in the operational suitability data established in accordance with Part-21, the privileges of the TRI shall be extended to further types when the TRI has:

(1) completed within the 12 months preceding the application, at least 15 route sectors, including take-offs and landings on the applicable aircraft type, of which 7 sectors may be completed in an FFS;

(2) completed the technical training and flight instruction parts of the relevant TRI course;

(3) passed the relevant sections of the assessment of competence in accordance with FCL.935 in order to demonstrate to an FIE or a TRE qualified in accordance with Subpart K his/her ability to instruct a pilot to the level required for the issue of a type rating, including pre-flight, post-flight and theoretical knowledge instruction.

(c) TRI for helicopters — TRI(H).

(1) The privileges of a TRI(H) are restricted to the type of helicopter in which the skill test for the issue of the TRI certificate was taken. Unless otherwise determined by in the operational suitability data established in accordance with Part-21, the privileges of the TRI shall be extended to further types when the TRI has:

(i) completed the appropriate type technical part of the TRI course on the applicable type of helicopter or an FSTD representing that type;

(ii) conducted at least 2 hours of flight instruction on the applicable type, under the supervision of an adequately qualified TRI(H); and

(iii) passed the relevant sections of the assessment of competence in accordance with FCL.935 in order to demonstrate to an FIE or TRE qualified in accordance with Subpart K his/her ability to instruct a pilot to the level required for the issue of a type rating, including pre-flight, post-flight and theoretical knowledge instruction.

(2) Before the privileges of a TRI(H) are extended from single-pilot to multi- pilot privileges on the same type of helicopters, the holder shall have at least 100 hours in multi-pilot operations on this type.

(d) Notwithstanding the paragraphs above, holders of a TRI certificate who have been issued with a type rating in accordance with FCL.725(e) shall be entitled to have their TRI privileges extended to that new type of aircraft.

FCL.915.TRI TRI — Prerequisites

An applicant for a TRI certificate shall:

(a) hold a CPL, MPL or ATPL pilot licence on the applicable aircraft category;

(b) for a TRI(MPA) certificate:

(1) have completed 1 500 hours flight time as a pilot on multi-pilot aeroplanes; and

(2) have completed, within the 12 months preceding the date of application, 30 route sectors, including take-offs and landings, as PIC or co-pilot on the applicable aeroplane type, of which 15 sectors may be completed in an FFS representing that type;

(c) for a TRI(SPA) certificate:

(1) have completed, within the 12 months preceding the date of application, 30 route sectors, including take-offs and landings, as PIC on the applicable aeroplane type, of which 15 sectors may be completed in an FFS representing that type; and

(2)

(i) have competed at least 500 hours flight time as pilot on aeroplanes, including 30 hours as PIC on the applicable type of aeroplane; or

(ii) hold or have held an FI certificate for multi-engine aeroplanes with IR(A) privileges;

(d) for TRI(H):

(1) for a TRI(H) certificate for single-pilot single-engine helicopters, have completed 250 hours as a pilot on helicopters;

(2) for a TRI(H) certificate for single-pilot multi-engine helicopters, have completed 500 hours as pilot of helicopters, including 100 hours as PIC on single-pilot multi-engine helicopters;

(3) for a TRI(H) certificate for multi-pilot helicopters, have completed 1 000 hours of flight time as a pilot on helicopters, including:

(i) 350 hours as a pilot on multi-pilot helicopters; or

(ii) for applicants already holding a TRI(H) certificate for single-pilot multi-engine helicopters, 100 hours as pilot of that type in multi-pilot operations.

(4) Holders of an FI(H) certificate shall be fully credited towards the requirements of (1) and (2) in the relevant single-pilot helicopter;

(e) for TRI(PL):

(1) have completed 1 500 hours flight time as a pilot on multi-pilot aeroplanes, powered-lift, or multi-pilot helicopters; and

(2) have completed, within the 12 months preceding the application, 30 route sectors, including take-offs and landings, as PIC or co-pilot on the applicable powered-lift type, of which 15 sectors may be completed in an FFS representing that type.

FCL.930.TRI TRI — Training course

(a) The TRI training course shall include, at least:

(1) 25 hours of teaching and learning;

(2) 10 hours of technical training, including revision of technical knowledge, the preparation of lesson plans and the development of classroom/ simulator instructional skills;

(3) 5 hours of flight instruction on the appropriate aircraft or a simulator representing that aircraft for single-pilot aircraft and 10 hours for multi- pilot aircraft or a simulator representing that aircraft.

(b) Applicants holding or having held an instructor certificate shall be fully credited towards the requirement of (a)(1).

(c) An applicant for a TRI certificate who holds an SFI certificate for the relevant type shall be fully credited towards the requirements of this paragraph for the issue of a TRI certificate restricted to flight instruction in simulators.

AMC1 FCL.930.TRI TRI — Training course

TRI TRAINING COURSE: AEROPLANES

GENERAL

(a) The aim of the TRI(A) training course is to train aeroplane licence holders to the level of competence defined in FCL.920 and adequate for a TRI.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the TRI task, and should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for an aeroplane type rating for which the applicant is qualified.

(c) The TRI(A) training course should give particular emphasis to the role of the individual in relation to the importance of human factors in the man-machine environment and the role of CRM.

(d) Special attention should be given to the applicant's maturity and judgment including an understanding of adults, their behavioural attitudes and variable levels of learning ability. During the training course the applicants should be made aware of their own attitudes to the importance of flight safety. It will be important during the training course to aim at giving the applicant the knowledge, skills and attitudes relevant to the role of the TRI.

(e) For a TRI(A) the amount of flight training will vary depending on the complexity of the aeroplane type. A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and should be related to the type of aeroplane on which the applicant wishes to instruct. The content of the training programme should cover training exercises applicable to the aeroplane type as set out in the applicable type rating courses.

(f) A TRI(A) may instruct in a TRI(A) course once he or she has conducted a minimum of four type rating instruction courses.

(g) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(h) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(i) The training course consists of three parts:

(1) Part 1: teaching and learning instruction that should comply with AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The technical theoretical knowledge instruction should comprise of not less than 10 hours training to include the revision of technical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the TRI(A) to instruct the technical theoretical knowledge syllabus.

(b) If a TRI(A) certificate for MP aeroplanes is sought, particular attention should be given to multi-crew cooperation. If a TRI(A) certificate for SP aeroplanes is sought, particular attention should be given to the duty in SP operations.

(c) The type rating theoretical syllabus should be used to develop the TRI(A)'s teaching skills in relation to the type technical course syllabus. The course instructor should deliver example lectures from the applicable type technical syllabus and the candidate instructor should prepare and deliver lectures on topics selected by the course instructor from the type rating course.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The course should be related to the type of aeroplane on which the applicant wishes to instruct.

(b) TEM, CRM and the appropriate use of behavioural markers should be integrated throughout.

(c) The content of the training programme should cover all the significant exercises applicable to the aeroplane type.

(d) The applicant for a TRI(A) certificate should be taught and made familiar with the device, its limitations, capabilities and safety features, and the instructor station, including emergency evacuation.

FSTD TRAINING

(e) The applicant for a TRI(A) certificate should be taught and made familiar with giving instruction from the instructor station. In addition, before being checked for base training instruction, the applicant for a TRI(A) should be taught ands made familiar with giving instruction from all operating positions, including demonstrations of appropriate handling exercises.

(f) Training courses should be developed to give the applicant experience in training a variety of exercises, covering both normal and abnormal operations. The syllabus should be tailored appropriate to the aeroplane type, using exercises considered more demanding for the student. This should include engine-out handling and engine-out operations in addition to representative exercises from the type transition course.

(g) The applicant should be required to plan, brief, train and debrief sessions using all relevant training techniques.

AEROPLANE TRAINING

(h) The applicant for a TRI(A) certificate should receive instruction in an FFS to a satisfactory level in:

(1) right hand seat familiarisation, which should include at least the following as pilot flying:

(i) re-flight preparation and use of checklists;

(ii) taxiing;

(iii) take-off;

(iv) rejected take-off;

(v) engine failure during take-off, after v_1;

(vi) engine inoperative approach and go-around;

(vii) one engine (critical) simulated inoperative landing;

(viii) other emergency and abnormal operating procedures (as necessary).

(2) aeroplane training techniques:

(i) methods for giving appropriate commentary;

(ii) particularities of handling the aeroplane in touch and go manoeuvres;

(iii) intervention strategies developed from situations role-played by a TRI course instructor, taken from but not limited to:

(A) take-off configuration warning;

(B) over controlling;

(C) high flare: long float;

(D) long flare;

(E) baulked landing;

(F) immediate go-around from touch;

(G) too high on approach: no flare;

(H) incorrect configuration;

(I) TAWS warning;

(J) misuse of rudder;

(K) over control in roll axis during flare;

(L) incapacitation;

(M) actual abnormal or emergencies.

(i) Additionally, if the applicant is required to train emergency or abnormal procedures in an aeroplane, synthetic device training as follows:

(1) appropriate methods and minimum altitudes for simulating failures;

(2) incorrect rudder inputs;

(3) failure of a critical engine;

(4) approach and full-stop landing with simulated engine-out.

(j) In this case, the abnormal manoeuvres refer to engine-out handling as necessary for completion of type rating training. If the applicant is required to train other abnormal items in the transition course, additional training will be required.

(k) Upon successful completion of the training above, the applicant should receive training in an aeroplane in-flight under the supervision of a TRI(A). At the completion of training the applicant instructor should be required to conduct a training flight under the supervision and to the satisfaction of a TRI(A) nominated for this purpose by the training organisation.

TRAINING FOR ASYMMETRIC POWER FLIGHT ON SP MET AEROPLANES

(l) During this part of the training, special emphasis is to be placed on the:

(1) circumstances in which actual feathering and un-feathering practice will be done, for example safe altitude; compliance with regulations about minimum altitude or height for feathering practice, weather conditions, distance from nearest available aerodrome.

(2) procedure to use for instructor and student co-operation, for example the correct use of touch drills and the prevention of misunderstandings, especially during feathering and unfeathering practice and when zero thrust is being used for asymmetric circuits. This procedure is to include positive agreement as to which engine is being shut down or re-started or set at zero thrust and identifying each control and naming the engine it is going to affect.

(3) consideration to be given to avoid over-working the operating engine, and the degraded performance when operating the aeroplane during asymmetric flight.

(4) need to use the specific checklist for the aeroplane type.

LONG BRIEFINGS:

(m) Flight on asymmetric power

(1) introduction to asymmetric flight;

(2) feathering the propeller: method of operation;

(3) effects on aeroplane handling at cruising speed;

(4) introduction to effects upon aeroplane performance;

(5) note foot load to maintain a constant heading (no rudder trim);

(6) un-feathering the propeller: regain normal flight;

(7) finding the zero thrust setting: comparison of foot load when feathered and with zero thrust set.

(8) effects and recognition of engine failure in level flight;

(9) the forces and the effects of yaw;

(10) types of failure:

(i) sudden or gradual;

(ii) complete or partial.

(11) yaw, direction and further effects of yaw;

(12) flight instrument indications;

(13) identification of failed engine;

(14) the couples and residual out of balance forces: resultant flight attitude;

(15) use of rudder to counteract yaw;

(16) use of aileron: dangers of misuse;

(17) use of elevator to maintain level flight;

(18) use of power to maintain a safe air speed and altitude;

(19) supplementary recovery to straight and level flight: simultaneous increase of speed and reduction in power;

(20) identification of failed engine: = idle engine;

(21) use of engine instruments for identification:

(i) fuel pressure or flow;

(ii) RPM gauge response effect of CSU action at lower and higher air speed;

(iii) engine temperature gauges.

(22) confirmation of identification: close the throttle of identified failed engine;

(23) effects and recognition of engine failure in turns;

(24) identification and control;

(25) side forces and effects of yaw.

(n) During turning flight:

(1) effect of 'inside' engine failure: effect sudden and pronounced;

(2) effect of 'outside' engine failure: effect less sudden and pronounced;

(3) the possibility of confusion in identification (particularly at low power):

(i) correct use of rudder;

(ii) possible need to return to lateral level flight to confirm correct identification;

(4) visual and flight instrument indications;

(5) effect of varying speed and power;

(6) speed and thrust relationship;

(7) at normal cruising speed and cruising power: engine failure clearly recognised;

(8) at low safe speed and climb power: engine failure most positively recognised;

(9) high speed descent and low power: possible failure to notice asymmetry (engine failure);

(o) Minimum control speeds:

(1) ASI colour coding: red radial line

Note: this exercise is concerned with the ultimate boundaries of controllability in various conditions that a student can reach in a steady asymmetric power state, approached by a gradual speed reduction. Sudden and complete failure should not be given at the flight manual v_{mca}. The purpose of the exercise is to continue the gradual introduction of a student to control an aeroplane in asymmetric power flight during extreme or critical situations. It is not a demonstration of v_{mca}.

(2) techniques for assessing critical speeds with wings level and recovery – dangers involved when minimum control speed and the stalling speed are very close: use of $v_{sse;}$

(3) establish a minimum control speed for each asymmetrically disposed engine: to establish critical engine (if applicable);

(4) effects on minimum control speeds of:

(i) bank;

(ii) zero thrust setting;

(iii) take-off configuration:

(A) landing gear down and take-off flap set;

(B) landing gear up and take-off flap set.

Note: it is important to appreciate that the use of 5 ° of bank towards the operating engine produces a lower v_{mca} and also a better performance than that obtained with the wings held level. It is now normal for manufacturers to use 5 ° of bank in this manner when determining the v_{mca} for the specific type. Thus the v_{mca} quoted in the aeroplane manual will have been obtained using the technique.

(p) Feathering and un-feathering:

(1) minimum heights for practising feathering or un-feathering drills;

(2) engine handling: precautions (overheating, icing conditions, priming, warm up and method of simulating engine failure: reference to aircraft engine manual and service instructions and bulletins).

(q) Engine failure procedure:

(1) once the maintenance of control has been achieved, the order in which the procedures are carried out will be determined by the phase of operation and the aircraft type;

(2) flight phase:

(i) in cruising flight;

(ii) critical phase such as immediately after take-off or during the approach to landing or during a go-around.

(r) Aircraft type

Variations will inevitably occur in the order of certain drills and checks due to differences between aeroplane types and perhaps between models of the same type. The flight manual or equivalent document (for example owner's manual or pilot's operating handbook) is to be consulted to establish the exact order of these procedures.

For example, one flight manual or equivalent document (for example owner's manual or pilot's operating handbook) may call for the raising of flaps and landing gear before feathering, whilst another may recommend feathering as a first step. The reason for this latter procedure could be due to the fact that some engines cannot be feathered if the rpm drops below a certain figure.

Again, in some aeroplanes, the raising of the landing gear may create more drag during retraction due to the transient position of the landing gear doors and as a result of this retraction would best be left until feathering has been accomplished and propeller drag reduced.

Therefore, the order in which the drills and checks are shown in this syllabus under immediate and subsequent actions are to be used as a general guide only and the exact order of precedence is determined by reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) for the specific aeroplane type being used on the course.

(s) In-flight engine failure in cruise or other flight phase not including take-off or landing:

(1) immediate actions:

(i) recognition of asymmetric condition;

(ii) identification and confirmation of failed engine:

(A) idle leg = idle engine;

(B) closing of throttle for confirmation.

(iii) cause and fire check:

(A) typical reasons for failure;

(B) methods of rectification.

(iv) feathering decision and procedure:

(A) reduction of other drag;

(B) need for speed but not haste;

(C) use of rudder trim.

(2) subsequent actions:

(i) live engine:

(A) temperature, pressures and power;

(B) remaining services;

(C) electrical load: assess and reduce as necessary;

(D) effect on power source for air driven instruments;

(E) landing gear;

(F) flaps and other services.

(ii) re-plan flight:

(A) ATC and weather;

(B) terrain clearance, SE cruise speed;

(C) decision to divert or continue.

(iii) fuel management: best use of remaining fuel;

(iv) dangers of re-starting damaged engine;

(v) action if unable to maintain altitude: effect of altitude on power available;

(vi) effects on performance;

(vii) effects on power available and power required;

(viii) effects on various airframe configuration and propeller settings;

(ix) use of flight or owner's manual:

(A) cruising;

(B) climbing: ASI colour coding (blue line);

(C) descending;

(D) turning.

(x) 'live' engine limitations and handling;

(xi) take-off and approach: control and performance;

(t) Significant factors:

(1) significance of take-off safety speed:

(i) effect of landing gear, flap, feathering, take-off, trim setting and systems for operating landing gear and flaps;

(ii) effect on mass, altitude and temperature (performance).

(2) significance of best SE climb speed (v_{yse}):

(i) acceleration to best engine climb speed and establishing a positive climb;

(ii) relationship of SE climb speed to normal climb speed;

(iii) action if unable to climb.

(3) significance of asymmetric committal height and speed: action if baulked below asymmetric committal height;

(u) Engine failure during take-off:

(1) below v_{mca} or unstick speed:

(i) accelerate or stop distance considerations;

(ii) prior use of flight manual data if available.

(2) above v_{mca} or unstick speed and below safety speed;

(3) immediate re-landing or use of remaining power to achieve forced landing;

(4) considerations:

(i) degree of engine failure;

(ii) speed at the time;

(iii) mass, altitude, temperature (performance);

(iv) configuration;

(v) length of runway remaining;

(vi) position of any obstacles ahead;

(v) Engine failure after take-off:

(1) simulated at a safe height and at or above take-off safety speed;

(2) considerations:

(i) need to maintain control;

(ii) use of bank towards operating engine;

(iii) use of available power achieving best SE climb speed;

(iv) mass, altitude, temperature (performance);

(v) effect of prevailing conditions and circumstances.

(3) Immediate actions:

(i) maintenance of control, including air speed and use of power;

(ii) recognition of asymmetric condition;

(iii) identification and confirmation of failed engine;

(iv) feathering and removal of drag (procedure for type);

(v) establishing best SE climb speed.

(4) Subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(i) cause and fire check;

(ii) live engine, handling considerations;

(iii) remaining services;

(iv) ATC liaison;

(v) fuel management.

Note: these procedures are applicable to aeroplane type and flight situation.

(w) Asymmetric committal height:

(1) Asymmetric committal height is the minimum height needed to establish a positive climb whilst maintaining adequate speed for control and removal of drag during an approach to a landing.

Because of the significantly reduced performance of many CS-23 aeroplanes when operating on one engine, consideration is to be given to a minimum height from which it would be safely possible to attempt a go-around procedure, during an approach when the flight path will have to be changed from a descent to a climb with the aeroplane in a high drag configuration.

Due to the height loss which will occur during the time that the operating engine is brought up to full power, landing gear and flap retracted, and the aeroplane established in a climb at v_{yse} a minimum height (often referred to as 'asymmetric committal height') is to be selected, below which the pilot should not attempt to take the aeroplane round again for another circuit. This height will be compatible with the aeroplane type, all up weight, altitude of the aerodrome being used, air temperature, wind, the height of obstructions along the climb out path, and pilot competence.

(2) Circuit approach and landing on asymmetric power:

(i) definition and use of asymmetric committal height;

(ii) use of standard pattern and normal procedures;

(iii) action if unable to maintain circuit height;

(iv) speed and power settings required;

(v) decision to land or go-around at asymmetric committal height: factors to be considered;

(3) Undershooting: importance of maintaining correct air speed, (not below v_{yse}).

(x) Speed and heading control:

(1) height, speed and power relationship: need for minimum possible drag;

(2) establishing positive climb at best SE rate of climb speed:

(i) effect of availability of systems, power for flap and landing gear;

(ii) operation and rapid clean up.

Note 1: The air speed at which the decision is made to commit the aeroplane to a landing or to go-around should normally be the best SE rate of climb speed and in any case not less than the safety speed.

Note 2: On no account should instrument approach 'decision height' and its associated procedures be confused with the selection of minimum height for initiating a go-around in asymmetric power flight.

(y) Engine failure during an all engines approach or missed approach:

(1) use of asymmetric committal height and speed considerations;

(2) speed and heading control: decision to attempt a landing, go-around or force land as circumstances dictate.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(z) Instrument flying on asymmetric power:

(1) considerations relating to aircraft performance during:

(i) straight and level flight;

(ii) climbing and descending;

(iii) standard rate turns;

(iv) level, climbing and descending turns including turns onto pre-selected headings.

(2) vacuum operated instruments: availability;

(3) electrical power source.

ADDITIONAL TRAINING FOR PRIVILEGES TO CONDUCT LINE FLYING UNDER SUPERVISION

(aa) In order to be able to conduct line flying under supervision, as provided in FCL.910.TRI(a), the TRI should have received the additional training described in paragraph (k) of this AMC.

TRAINING WHERE NO FSTD EXISTS

(ab) Where no FSTD exists for the type for which the certificate is sought, a similar course of training should be conducted in the applicable aeroplane type. This includes all elements listed under this sub paragraph, the synthetic device elements being replaced with appropriate exercises in an aeroplane of the applicable type.

AMC2 FCL.930.TRI TRI — training course

HELICOPTERS

GENERAL

(a) The aim of the TRI(H) course is to train helicopter licence holders to the level of competence defined in FCL.920 and adequate for a TRI.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the TRI(H) task, and should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for a helicopter type rating for which the applicant is qualified.

(c) The TRI(H) training course should give particular emphasis to the role of the individual in relation to the importance of human factors in the man-machine environment and the role of CRM.

(d) Special attention should be given to the applicant's maturity and judgment including an understanding of adults, their behavioural attitudes and variable levels of learning ability. During the training course the applicants should be made aware of their own attitudes to the importance of flight safety. It will be important during the course of training to aim at giving the applicant the knowledge, skills and attitudes relevant to the role of the TRI.

(e) For a TRI(H) certificate the amount of flight training will vary depending on the complexity of the helicopter type.

(f) A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and should be related to the type of helicopter on which the applicant wishes to instruct. The content of the training program should cover training exercises applicable to the helicopter type as set out in the applicable type rating course syllabus.

(g) A TRI(H) may instruct in a TRI(H) course once he or she has conducted a minimum of four type rating instruction courses.

CONTENT

(h) The training course consists of three parts:

(1) Part 1: teaching and learning, that should comply with AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The technical theoretical knowledge instruction should comprise of not less than 10 hours training to include the revision of technical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the TRI(H) to instruct the technical theoretical knowledge syllabus.

(b) If a TRI(H) certificate for MP helicopters is sought, particular attention should be given to multi-crew cooperation.

(c) The type rating theoretical syllabus should be used to develop the TRI(H)'s teaching skills in relation to the type technical course syllabus. The course instructor should deliver example lectures from the applicable type technical syllabus and the candidate instructor should prepare and deliver lectures on topics selected by the course instructor from the subject list below:

(1) helicopter structure, transmissions, rotor and equipment, normal and abnormal operation of systems:

(i) dimensions;

(ii) engine including aux. power unit, rotors and transmissions;

(iii) fuel system;

(iv) air-conditioning;

(v) ice protection, windshield wipers and rain repellent;

(vi) hydraulic system;

(vii) landing gear;

(viii) flight controls, stability augmentation and autopilot systems;

(ix) electrical power supply;

(x) flight instruments, communication, radar and navigation equipment;

(xi) cockpit, cabin and cargo compartment;

(xii) emergency equipment.

(2) limitations:

(i) general limitations, according to the helicopter flight manual;

(ii) minimum equipment list.

(3) performance, flight planning and monitoring:

(i) performance;

(ii) light planning.

(4) load and balance and servicing:

(i) load and balance;

(ii) servicing on ground;

(5) emergency procedures;

(6) special requirements for helicopters with EFIS;

(7) optional equipment.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The amount of flight training will vary depending on the complexity of the helicopter type. At least 5 hours flight instruction for a SP helicopter and at least 10 hours for a MP ME helicopter should be counted. A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and related to the type of helicopter on which the applicant wishes to instruct. The content of the training programme should only cover training exercises applicable to the helicopter type as set out in Appendix 9 to Part-FCL.

(b) If a TRI(H) certificate for MP helicopters is sought, particular attention should be given to MCC.

(c) If a TRI(H) certificate for revalidation of instrument ratings is sought, then the applicant should hold a valid instrument rating.

FLIGHT OR FSTD TRAINING

(d) The training course should be related to the type of helicopter on which the applicant wishes to instruct.

(e) For MP helicopter type ratings MCC, CRM and the appropriate use of behavioural markers should be integrated throughout.

(f) The content of the training programme should cover identified and significant exercises applicable to the helicopter type.

FSTD TRAINING

(g) The applicant for a TRI(H) certificate should be taught and made familiar with the device, its limitations, capabilities and safety features, and the instructor station.

(h) The applicant for a TRI(H) certificate should be taught and made familiar with giving instruction from the instructor station seat as well as the pilot's seats, including demonstrations of appropriate handling exercises.

(i) Training courses should be developed to give the applicant experience in training a variety of exercises, covering both normal and abnormal operations. The syllabus should be tailored appropriate to the helicopter type, using exercises considered more demanding for the student. This should include engine-out handling and engine-out operations in addition to representative exercises from the type transition course.

(j) The applicant should be required to plan, brief, train and debrief sessions using all relevant training techniques.

HELICOPTER TRAINING

(k) The applicant for a TRI(H) certificate should receive instruction in an FSTD to a satisfactory level in:

(1) left hand seat familiarisation, and in addition right hand seat familiarisation where instruction is to be given to co-pilots operating in the left hand seat, which should include at least the following as pilot flying:

(i) pre-flight preparation and use of checklists;

(ii) taxiing: ground and air;

(iii) take-off and landings;

(iv) engine failure during take-off, before DPATO;

(v) engine failure during take-off, after DPATO;

(vi) engine inoperative approach and go-around;

(vii) one engine simulated inoperative landing;

(viii) autorotation to landing or power recovery;

(ix) other emergency and abnormal operating procedures (as necessary);

(x) instrument departure, approach and go-around with one engine simulated inoperative should be covered where TRI(H) privileges include giving instrument instruction for the extension of an IR(H) to additional types.

(2) helicopter training techniques:

(i) methods for giving appropriate commentary;

(ii) instructor demonstrations of critical manoeuvres with commentary;

(iii) particularities and safety considerations associated with handling the helicopter in critical manoeuvres such as one-engine-inoperative and autorotation exercises;

(iv) where relevant, the conduct of instrument training with particular emphasis on weather restrictions, dangers of icing and limitations on the conduct of critical manoeuvres in instrument meteorological conditions;

(v) intervention strategies developed from situations role-played by a TRI(H) course instructor, taken from but not limited to:

(A) incorrect helicopter configuration;

(B) over controlling;

(C) incorrect control inputs;

(D) excessive flare close to the ground;

(E) one-engine-inoperative take-off and landings;

(F) incorrect handling of autorotation;

(G) static or dynamic rollover on take-off or landing;

(H) too high on approach with associated danger of vortex ring or settling with power;

(I) incapacitation;

(L) abnormal and emergency procedures and appropriate methods and minimum altitudes for simulating failures in the helicopter;

(M) failure of the driving engine during OEI manoeuvres.

(l) Upon successful completion of the training above, the applicant should receive sufficient training in an helicopter in-flight under the supervision of a TRI(H) to a level where the applicant is able to conduct the critical items of the type rating course to a safe standard. Of the minimum course requirements of 5 hours flight training for a SP helicopter or 10 hours for a MP helicopter, up to 3 hours of this may be conducted in an FSTD.

TRAINING WHERE NO FSTD EXISTS

(m) Where no FSTD exists for the type for which the TRI(H) certificate is sought, a similar course of training should be conducted in the applicable helicopter type. This includes all elements listed under sub paragraphs (k)(1) and (2) of this AMC, the FSTD elements being replaced with appropriate exercises in a helicopter of the applicable type, subject to any restrictions placed on the conduct of critical exercises associated with helicopter flight manual limitations and safety considerations.

FCL.935.TRI TRI — Assessment of competence

If the TRI assessment of competence is conducted in an FFS, the TRI certificate shall be restricted to flight instruction in FFSs.

The restriction shall be lifted when the TRI has passed the assessment of competence on an aircraft.

FCL.940.TRI TRI — Revalidation and renewal

(a) *Revalidation*

(1) Aeroplanes. For revalidation of a TRI(A) certificate, the applicant shall, within the last 12 months preceding the expiry date of the certificate, fulfil one of the following 3 requirements:

(i) conduct one of the following parts of a complete type rating training course: simulator session of at least 3 hours or one air exercise of at least 1 hour comprising a minimum of 2 take-offs and landings;

(ii) receive instructor refresher training as a TRI at an ATO;

(iii) pass the assessment of competence in accordance with FCL.935.

(2) Helicopters and powered lift. For revalidation of a TRI (H) or TRI(PL) certificate, the applicant shall, within the validity period of the TRI certificate, fulfil 2 of the following 3 requirements:

(i) complete 50 hours of flight instruction on each of the types of aircraft for which instructional privileges are held or in an FSTD representing those types, of which at least 15 hours shall be within the 12 months preceding the expiry date of the TRI certificate.

In the case of TRI(PL), these hours of flight instruction shall be flown as a TRI or type rating examiner (TRE), or SFI or synthetic flight examiner (SFE). In the case of TRI(H), time flown as FI, instrument rating instructor (IRI), synthetic training instructor (STI) or as any kind of examiner shall also be relevant for this purpose;

(ii) receive instructor refresher training as a TRI at an ATO;

(iii) pass the assessment of competence in accordance with FCL.935.

(3) For at least each alternate revalidation of a TRI certificate, the holder shall have to pass the assessment of competence in accordance with FCL.935.

(4) If a person holds a TRI certificate on more than one type of aircraft within the same category, the assessment of competence taken on one of those types shall revalidate the TRI certificate for the other types held within the same category of aircraft.

(5) Specific requirements for revalidation of a TRI(H). A TRI(H) holding an FI(H) certificate on the relevant type shall have full credit towards the requirements in (a) above. In this case, the TRI(H) certificate will be valid until the expiry date of the FI(H) certificate.

(b) *Renewal*

(1) Aeroplanes. If the TRI (A) certificate has lapsed the applicant shall have:

(i) completed within the last 12 months preceding the application at least 30 route sectors, to include take-offs and landings on the applicable aeroplane type, of which not more than 15 sectors may be completed in a flight simulator;

(ii) completed the relevant parts of a TRI course at an approved ATO;

(iii) conducted on a complete type rating course at least 3 hours of flight instruction on the applicable type of aeroplane under the supervision of a TRI(A).

(2) Helicopters and powered lift. If the TRI (H) or TRI(PL) certificate has lapsed, the applicant shall, within a period of 12 months before renewal:

(i) receive instructor refresher training as a TRI at an ATO, which should cover the relevant elements of the TRI training course; and

(ii) pass the assessment of competence in accordance with FCL.935 in each of the types of aircraft in which renewal of the instructional privileges is sought.

SECTION 5 - Specific requirements for the class rating instructor — CRI

FCL.905.CRI CRI — Privileges and conditions

(a) The privileges of a CRI are to instruct for:

(1) the issue, revalidation or renewal of a class or type rating for single-pilot aeroplanes, except for single-pilot high performance complex aeroplanes, when the privileges sought by the applicant are to fly in single-pilot operations;

(2) a towing or aerobatic rating for the aeroplane category, provided the CRI holds the relevant rating and has demonstrated the ability to instruct for that rating to an FI qualified in accordance with FCL.905.FI(i);

(3) extension of LAPL(A) privileges to another class or variant of aeroplane.

(b) The privileges of a CRI are restricted to the class or type of aeroplane in which the instructor assessment of competence was taken. The privileges of the CRI shall be extended to further classes or types when the CRI has completed, within the last 12 months:

(1) 15 hours flight time as PIC on aeroplanes of the applicable class or type of aeroplane;

(2) one training flight from the right hand seat under the supervision of another CRI or FI qualified for that class or type occupying the other pilot's seat.

(c) Applicants for a CRI for multi-engine aeroplanes holding a CRI certificate for single-engine aeroplanes shall have fulfilled the prerequisites for a CRI established in FCL.915.CRI(a) and the requirements of FCL.930.CRI(a)(3) and FCL.935.

FCL.915.CRI CRI — Prerequisites

An applicant for a CRI certificate shall have completed at least:

(a) for multi-engine aeroplanes:

(1) 500 hours flight time as a pilot on aeroplanes;

(2) 30 hours as PIC on the applicable class or type of aeroplane;

(b) for single-engine aeroplanes:

(1) 300 hours flight time as a pilot on aeroplanes;

(2) 30 hours as PIC on the applicable class or type of aeroplane.

FCL.930.CRI CRI — Training course

(a) The training course for the CRI shall include, at least:

(1) 25 hours of teaching and learning instruction;

(2) 10 hours of technical training, including revision of technical knowledge, the preparation of lesson plans and the development of classroom/ simulator instructional skills;

(3) 5 hours of flight instruction on multi-engine aeroplanes, or 3 hours of flight instruction on single-engine aeroplanes, given by an FI(A) qualified in accordance with FCL.905.FI(i).

(b) Applicants holding or having held an instructor certificate shall be fully credited towards the requirement of (a)(1).

AMC1 FCL.930.CRI CRI — Training course

GENERAL

(a) The aim of the CRI training course is to train aircraft licence holders to the level of competence defined in FCL.920 and adequate to a CRI.

(b) The training course should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for any class or type rating for non-complex non-high performance SP aeroplanes for which the applicant is qualified.

(c) The flight training should be aimed at ensuring that the applicant is able to teach the air exercises safely and efficiently to students undergoing a course of training for the issue of a class or type rating for non-complex non-high performance SP aeroplanes. The flight training may take place on the aeroplane or an FFS.

(d) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(e) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(f) The training course consists of three parts:

(1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

This syllabus is concerned only with the training on ME aeroplanes. Therefore, other knowledge areas, common to both SE and ME aeroplanes, should be revised as necessary to cover the handling and operating of the aeroplane with all engines operative, using the applicable sections of the ground subjects syllabus for the FI course. Additionally, the ground training should include 25 hours of classroom work to develop the applicant's ability to teach a student the knowledge and understanding required for the air exercise section of the ME training course. This part will include the long briefings for the air exercises.

THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

Suggested breakdown of course classroom hours:

Tuition hours	Practice in class	Topic	Internal progress test
1.00		Aviation legislation	1.00
2.00		Performance, all engines operating, including mass and balance	
2.00		Asymmetric flight Principles of flight	
2.00	2.00	Control in asymmetric flight Minimum control and safety speeds Feathering and un-feathering	
2.00		Performance in asymmetric flight	1.00
2.00		Specific type of aeroplane – operation of systems.	1.00
		Airframe and engine limitations	
4.00	5.00	Briefings for air exercises progress	
15.00	7.00		3.00
Course total	25.00 (including progress test)		

GENERAL SUBJECTS

(a) Air legislation:

(1) aeroplane performance group definitions;

(2) methods of factoring gross performance.

(b) Asymmetric power flight;

(c) Principles of flight;

(d) The problems:

(1) asymmetry;

(2) control;

(3) performance;

(e) The forces and couples:

(1) offset thrust line;

(2) asymmetric blade effect;

(3) offset drag line;

(4) failed engine propeller drag;

(5) total drag increase;

(6) asymmetry of lift;

(7) uneven propeller slipstream effect;

(8) effect of yaw in level and turning flight;

(9) thrust and rudder side force couples;

(10) effect on moment arms.

(f) Control in asymmetric power flight:

(1) use, misuse and limits of:

(i) rudder;

(ii) aileron;

(iii) elevators.

(2) effect of bank or sideslip and balance;

(3) decrease of aileron and rudder effectiveness;

(4) fin stall possibility;

(5) effect of IAS and thrust relationship;

(6) effect of residual unbalanced forces;

(7) foot loads and trimming.

(g) Minimum control and safety speeds:

(1) minimum control speed (v_{mc});

(2) definition;

(3) origin;

(4) factors affecting (v_{mc}):

(i) thrust;

(ii) mass and centre of gravity position;

(iii) altitude;

(iv) landing gear;

(v) flaps;

(vi) cowl flaps or cooling gills;

(vii) turbulence or gusts;

(viii) pilot reaction or competence;

(ix) banking towards the operating engine;

(x) drag;

(xi) feathering;

(xii) critical engine.

(5) take-off safety speed;

(6) definition or origin of $v_{2;}$

(7) other relevant v codes;

(h) Aeroplane performance: one engine inoperative:

(1) effect on excess power available;

(2) SE ceiling;

(3) cruising, range and endurance;

(4) acceleration and deceleration;

(5) zero thrust, definition and purpose;

(i) Propellers:

(1) variable pitch: general principles;

(2) feathering and un-feathering mechanism and limitations (for example minimum RPM);

(j) Specific aeroplane type;

(k) Aeroplane and engine systems:

(1) operation normal;

(2) operation abnormal;

(3) emergency procedures.

(l) Limitations: airframe:

(1) load factors;

(2) landing gear and flap limiting speeds (v_{lo} and v_{fe});

(3) rough air speed (v_{ra});

(4) maximum speeds (v_{no} and v_{ne}).

(m) Limitations: engine:

(1) RPM and manifold pressure;

(2) oil temperature and pressure;

(3) emergency procedures.

(n) Mass and balance:

(to be covered in conjunction with the flight manual or equivalent document (for example owner's manual or pilot's operating handbook))

(1) mass and balance documentation for aeroplane type;

(2) revision of basic principles;

(3) calculations for specific aeroplane type.

(o) Mass and performance:

(to be covered in conjunction with the flight manual or equivalent document (for example owner's manual or pilot's operating handbook))

(1) calculations for specific aeroplane type (all engines operating);

(2) take-off run;

(3) take-off distance;

(4) accelerate and stop distance;

(5) landing distance;

(6) landing run;

(7) take-off or climb out flight path;

(8) calculations for specific aeroplane type (one engine operating);

(9) climb out flight path;

(10) landing distance;

(11) landing run.

Part 3

FLIGHT INSTRUCTION SYLLABUS: NORMAL FLIGHT

(a) This part is similar to the air exercise sections of the SE FI course, including 'Introduction to instrument flying' except that the objectives, airmanship considerations and common errors are related to the operation of an ME aeroplane.

(b) The purpose of this part is to acquaint the applicant with the teaching aspects of the operational procedures and handling of an ME aeroplane with all engines functioning.

(c) The following items should be covered:

(1) aeroplane familiarisation;

(2) pre-flight preparation and aeroplane inspection;

(3) engine starting procedures;

(4) taxiing;

(5) pre take-off procedures;

(6) the take-off and initial climb:

(i) into wind;

(ii) crosswind;

(iii) short field.

(7) climbing;

(8) straight and level flight;

(9) descending (including emergency descent procedures);

(10) turning;

(11) slow flight;

(12) stalling and recoveries;

(13) instrument flight: basic;

(14) emergency drills (not including engine failure);

(15) circuit, approach and landing:

(i) into wind;

(ii) croswind;

(iii) short field;

(16) mislanding and going round again;

(17) actions after flight.

AIR EXERCISES

(d) The following air exercises are developments of the basic SE syllabus which are to be related to the handling of ME types to ensure that the student learns the significance and use of controls and techniques which may be strange to the student in all normal, abnormal and emergency situations, except that engine failure and flight on asymmetric power are dealt with separately in the air exercises in Part 2.

EXERCISE 1: FAMILIARISATION WITH THE AEROPLANE

(a) Long briefing objectives:

(1) introduction to the aeroplane;

(2) explanation of the cockpit layout;

(3) systems and controls;

(4) aeroplane power plant;

(5) checklists and drills;

(6) differences when occupying the instructor's seat;

(7) emergency drills:

(i) action in event of fire in the air and on the ground;

(ii) escape drills: location of exits and use of emergency equipment (for example fire extinguishers, etc.).

(8) pre-flight preparation and aeroplane inspection:

(i) aeroplane documentation;

(ii) external checks;

(iii) internal checks;

(iv) harness, seat or rudder pedal adjustment;

(9) engine starting procedures:

(i) use of checklists;

(ii) checks before starting;

(iii) checks after starting.

(b) Air exercise:

(1) external features;

(2) cockpit layout;

(3) aeroplane systems;

(4) checklists and drills;

(5) action if fire in the air and on the ground;

(i) engine;

(ii) cabin;

(iii) electrical.

(6) systems failure (as applicable to type);

(7) escape drills (location and use of emergency equipment and exits);

(8) preparation for and action after flight:

(i) flight authorisation and aeroplane acceptance;

(ii) technical log or certificate of maintenance release;

(iii) mass and balance and performance considerations;

(iv) external checks;

(v) internal checks, adjustment of harness or rudder pedals;

(vi) starting and warming up engines;

(vii) checks after starting;

(viii) radio navigation and communication checks;

(ix) altimeter checks and setting procedures;

(x) power checks;

(xi) running down and switching off engines;

(xii) completion of authorisation sheet and aeroplane serviceability documents.

EXERCISE 2: TAXIING

(a) Long briefing objectives:

(1) pre-taxiing area precautions (greater mass: greater inertia);

(2) effect of differential power;

(3) precautions on narrow taxiways;

(4) pre take-off procedures:

(i) use of checklist;

(ii) engine power checks;

(iii) pre take-off checks;

(iv) instructor's briefing to cover the procedure to be followed should an emergency occur during take-off, for example engine failure.

(5) the take-off and initial climb:

(i) ATC considerations;

(ii) factors affecting the length of the take-off run or distance;

(iii) correct lift-off speed;

(iv) importance of safety speed;

(v) crosswind take-off, considerations and procedures;

(vi) short field take-off, considerations and procedures;

(vii) engine handling after take-off: throttle, pitch and engine synchronisation.

(6) climbing:

(i) pre-climbing checks;

(ii) engine considerations (use of throttle or pitch controls);

(iii) maximum rate of climb speed;

(iv) maximum angle of climb speed;

(v) synchronising the engines.

(b) Air exercise

(1) pre-taxing checks;

(2) starting, control of speed and stopping;

(3) control of direction and turning;

(4) turning in confined spaces;

(5) leaving the parking area;

(6) freedom of rudder movement (importance of pilot ability to use full rudder travel);

(7) instrument checks;

(8) emergencies (brake or steering failure);

(9) pre take-off procedures:

(i) use of checklist;

(ii) engine power and system checks;

(iii) pre take-off checks;

(iv) instructor's briefing if emergencies during take-off.

(10) the take-off and initial climb:

(i) ATC considerations;

(ii) directional control and use of power;

(iii) lift-off speed;

(iv) crosswind effects and procedure;

(v) short field take-off and procedure.

(vi) procedures after take-off (at an appropriate stage of the course):

(A) landing gear retraction;

(B) flap retraction (as applicable);

(C) selection of manifold pressure and RPM;

(D) engine synchronisation;

(E) other procedures (as applicable).

(11) climbing:

(i) pre-climbing checks;

(ii) power selection for normal and maximum rate climb;

(iii) engine and RPM limitations;

(iv) effect of altitude on manifold pressure, full throttle;

(v) levelling off: power selection;

(vi) climbing with flaps down;

(vii) recovery to normal climb;

(viii) en-route climb (cruise climb);

(ix) maximum angle of climb;

(x) altimeter setting procedures;

(xi) prolonged climb and use of cowl flaps or cooling gills;

(xii) instrument appreciation.

EXERCISE 3: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) selection of power: throttle or pitch controls;

(2) engine synchronisation;

(3) fuel consumption aspects;

(4) use of trimming controls: elevator and rudder (aileron as applicable);

(5) operation of flaps:

(i) effect on pitch attitude;

(ii) effect on air speed.

(6) operation of landing gear:

(i) effect on pitch attitude;

(ii) effect on air speed.

(7) use of mixture controls;

(8) use of alternate air or carburettor heat controls;

(9) operation of cowl flaps or cooling gills;

(10) use of cabin ventilation and heating systems;

(11) operation and use of the other systems (as applicable to type);

(12) descending:

(i) pre-descent checks;

(ii) normal descent;

(iii) selection of throttle or pitch controls;

(iv) engine cooling considerations;

(v) emergency descent procedure.

(13) turning:

(i) medium turns;

(ii) climbing and descending turns;

(iii) steep turns (45 ° of bank or more).

(b) Air exercise:

(1) at normal cruising power:

(i) selection of cruise power;

(ii) manifold pressure or RPM;

(iii) engine synchronisation;

(iv) use of trimming controls;

(v) performance considerations: range or endurance.

(2) instrument appreciation;

(3) operation of flaps (in stages):

(i) air speed below v_{fe};

(ii) effect on pitch attitude;

(iii) effect on air speed.

(4) operation of landing gear:

(i) air speed below v_{lo} / v_{le};

(ii) effect on pitch attitude;

(iii) effect on air speed.

(5) use of mixture controls;

(6) use of alternate air or carburettor control;

(7) operation of cowl flaps or cooling gills;

(8) operation of cabin ventilation or heating systems;

(9) operation and use of other systems (as applicable to type);

(10) descending;

(i) pre-descent checks;

(ii) power selection: manifold pressure or RPM;

(iii) powered descent (cruise descent);

(iv) engine cooling considerations: use of cowl flaps or cooling gills;

(v) levelling off;

(vi) descending with flaps down;

(vii) descending with landing gear down;

(viii) altimeter setting procedure;

(ix) instrument appreciation;

(x) emergency descent:

(A) as applicable to type;

(B) limitations in turbulence v_{no}.

(11) turning:

(i) medium turns;

(ii) climbing and descending turns;

(iii) steep turns: 45 ° of ban;

(iv) instrument appreciation.

EXERCISE 4: SLOW FLIGHT

(a) Long briefing objectives:

(1) aeroplane handling characteristics during slow flight: flight at v_{s1} and v_{so} +5 knots;

(2) simulated go-around from slow flight:

(i) at V_{sse} with flaps down;

(ii) note pitch trim change.

(3) stalling:

(i) power selection;

(ii) symptoms approaching the stall;

(iii) full stall characteristics;

(iv) recovery from the full stall;

(v) recovery at the incipient stall;

(vi) stalling and recovery in the landing configuration;

(vii) recovery at the incipient stage in the landing configuration.

(4) instrument flight (basic):

(i) straight and level;

(ii) climbing;

(iii) turning;

(iv) descending.

(5) emergency drills (not including engine failure), as applicable to type;

(6) circuit approach and landing:

(i) downwind leg:

(A) air speed below v_{fe};

(B) use of flaps (as applicable);

(C) pre-landing checks;

(D) position to turn onto base leg.

(ii) base leg:

(A) selection of power (throttle or pitch), flaps and trimming controls;

(B) maintenance of correct air speed.

(iii) final approach:

(A) power adjustments (early reaction to undershooting);

(B) use of additional flaps (as required);

(C) confirmation of landing gear down;

(D) selection 'touch down' point;

(E) air speed reduction to V_{at};

(F) maintenance of approach path.

(iv) landing:

(A) greater sink rate;

(B) longer landing distance and run;

(C) crosswind approach and landing;

(D) crosswind considerations;

(E) short field approach and landing;

(F) short field procedure: considerations.

(b) Air exercise

(1) safety checks;

(2) setting up and maintaining (flaps up);

(i) v_{s1} + 5 knots;

(ii) note aeroplane handling characteristics.

(3) setting up and maintaining (flaps down):

(i) v_{so} + 5 knots;

(ii) note aeroplane handling characteristics.

(4) simulated go-around from a slow flight with flaps:

(i) down and air speed not below V_{sse}, for example air speed at V_{sse} or v_{mca} + 10 knots;

(ii) increase to full power and enter a climb;

(iii) note pitch change.

(5) resume normal flight.

(6) stalling;

(i) selection of RPM;

(ii) stall symptoms;

(iii) full stall characteristics;

(iv) recovery from the full stall: care in application of power;

(v) recovery at the incipient stage;

(vi) stalling and recovery in landing configuration;

(vii) stall recovery at the incipient stage in the landing configuration.

(7) instrument flight (basic):

(i) straight and level;

(ii) climbing;

(iii) turning;

(iv) descending.

(8) emergency drills (not including engine failure), as applicable to type;

(9) circuit, approach and landing:

(i) downwind leg:

(A) control of speed (below v_{fe});

(B) flaps as applicable;

(C) pre-landing checks;

(D) control of speed and height;

(E) base leg turn.

(ii) base leg:

(A) power selection;

(B) use of flap and trimming controls;

(C) maintenance of correct air speed.

(iii) final approach:

(A) use of additional flap (as required);

(B) confirmation of landing gear down;

(C) selection of touchdown point;

(D) air speed reduction to V_{at};

(E) maintaining correct approach path: use of power.

(iv) landing:

(A) control of sink rate during flare;

(B) crosswind considerations;

(C) longer landing roll;

(D) short or soft field approach and landing;

(E) considerations and precautions.

(10) Asymmetric power flight.

During this part, special emphasis is to be placed on the:

(i) circumstances in which actual feathering and un-feathering practice will be done, for example safe altitude; compliance with regulations about minimum altitude or height for feathering practice, weather conditions, distance from nearest available aerodrome;

(ii) procedure to use for instructor and student co-operation, for example the correct use of touch drills and the prevention of misunderstandings, especially during feathering and un-feathering practice and when zero thrust is being used for asymmetric circuits. This procedure is to include positive agreement as to which engine is being shut down or re-started or set at zero thrust and identifying each control and naming the engine it is going to affect;

(iii) consideration to be given to avoid over-working the operating engine, and the degraded performance when operating the aeroplane during asymmetric flight;

(iv) need to use the specific checklist for the aeroplane type.

EXERCISE 5: FLIGHT ON ASYMMETRIC POWER

(a) Long briefing objectives:

(1) introduction to asymmetric flight:

(2) feathering the propeller: method of operation;

(3) effects on aeroplane handling at cruising speed;

(4) introduction to effects upon aeroplane performance;

(5) note foot load to maintain a constant heading (no rudder trim);

(6) un-feathering the propeller;

(7) return to normal flight finding the zero thrust setting;

(8) comparison of foot load when feathered and with zero thrust set.

(9) effects and recognition of engine failure in level flight;

(10) forces and the effects of yaw;

(11) types of failure:

(i) sudden or gradual;

(ii) complete or partial.

(12) yaw, direction and further effects of yaw;

(13) flight instrument indications;

(14) identification of failed engine;

(15) the couples and residual out of balance forces: resultant flight attitude;

(16) use of rudder to counteract yaw;

(17) use of aileron: dangers of misuse;

(18) use of elevator to maintain level flight;

(19) use of power to maintain a safe air speed and altitude;

(20) supplementary recovery to straight and level flight: simultaneous increase of speed and reduction in power;

(21) identification of failed engine: idle leg = idle engine;

(22) use of engine instruments for identification:

(i) fuel pressure or flow;

(ii) RPM gauge response effect of CSU action at lower and higher air speed;

(iii) engine temperature gauges.

(23) confirmation of identification: close the throttle of identified failed engine;

(24) effects and recognition of engine failure in turns;

(25) identification and control;

(26) side forces and effects of yaw.

(27) During turning flight:

(i) effect of 'inside' engine failure: effect sudden and pronounced;

(ii) effect of 'outside' engine failure: effect less sudden and pronounced;

(iii) the possibility of confusion in identification (particularly at low power):

(A) correct use of rudder;

(B) possible need to return to lateral level flight to confirm correct identification.

(iv) visual and flight instrument indications;

(v) effect of varying speed and power;

(vi) speed and thrust relationship;

(vii) at normal cruising speed and cruising power: engine failure clearly recognised;

(viii) at low safe speed and climb power: engine failure most positively recognised;

(ix) high speed descent and low power: possible failure to notice asymmetry (engine failure).

(28) Minimum control speeds:

(i) ASI colour coding: red radial line.

Note: this exercise is concerned with the ultimate boundaries of controllability in various conditions that a student can reach in a steady asymmetric power state, approached by a gradual speed reduction. Sudden and complete failure should not be given at the Flight Manual v_{mca}. The purpose of the exercise is to continue the gradual introduction of a student to control an aeroplane in asymmetric power flight during extreme or critical situations. It is not a demonstration of v_{mca}.

(ii) Techniques for assessing critical speeds with wings level and recovery: dangers involved when minimum control speed and the stalling speed are very close: use of $V_{sse;}$

(iii) Establish a minimum control speed for each asymmetrically disposed engine to establish critical engine (if applicable);

(iv) Effects on minimum control speeds of:

(A) bank;

(B) zero thrust setting;

(C) take-off configuration:

(a) landing gear down and take-off flap set;

(b) landing gear up and take-off flap set.

Note: it is important to appreciate that the use of 5 ° of bank towards the operating engine produces a lower v_{mca} and also a better performance than that obtained with the wings held level. It is now normal for manufacturers to use 5 ° of bank in this manner when determining the v_{mca} for the specific type. Thus, the v_{mca} quoted in the aeroplane manual will have been obtained using the technique.

(29) Feathering and un-feathering:

(i) minimum heights for practising feathering or un-feathering drills;

(ii) engine handling: precautions (overheating, icing conditions, priming, warm-up, method of simulating engine failure: reference to aircraft engine manual and service instructions and bulletins).

(30) Engine failure procedure:

(i) once the maintenance of control has been achieved, the order in which the procedures are carried out will be determined by the phase of operation and the aircraft type.

(ii) flight phase:

(A) in cruising flight;

(B) critical phase such as immediately after take-off or during the approach to landing or during a go-around.

(31) Aircraft type:

Variations will inevitably occur in the order of certain drills and checks due to differences between aeroplane types and perhaps between models of the same type, and the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) is to be consulted to establish the exact order of these procedures.

For example, one flight manual or equivalent document (for example owner's manual or pilot's operating handbook) may call for the raising of flaps and landing gear before feathering, whilst another may recommend feathering as a first step. The reason for this latter procedure could be due to the fact that some engines cannot be feathered if the RPM drops below a certain figure.

Again, in some aeroplanes, the raising of the landing gear may create more drag during retraction due to the transient position of the landing gear doors and as a result of this retraction would best be left until feathering has been accomplished and propeller drag reduced.

Therefore, the order in which the drills and checks are shown in this syllabus under 'immediate actions' and 'subsequent actions' are to be used as a general guide only and the exact order of precedence is determined by reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) for the specific aeroplane type being used on the course.

(32) In-flight engine failure in cruise or other flight phase not including take-off or landing:

(i) immediate actions:

(A) recognition of asymmetric condition and control of the aircraft;

(B) identification and confirmation of failed engine:

(a) idle leg = idle engine;

(b) closing of throttle for confirmation.

(C) cause and fire check:

(a) typical reasons for failure;

(b) methods of rectification.

(D) feathering decision and procedure:

(a) reduction of other drag;

(b) need for speed but not haste;

(c) use of rudder trim.

(ii) subsequent actions;

(A) live engine:

(a) temperature, pressures and power;

(b) remaining services;

(c) electrical load: assess and reduce as necessary;

(d) effect on power source for air driven instruments;

(e) landing gear;

(f) flaps and other services.

(B) re-plan flight:

(a) ATC and weather;

(b) terrain clearance, SE cruise speed;

(c) decision to divert or continue.

(C) fuel management: best use of remaining fuel;

(D) dangers of re-starting damaged engine;

(E) action if unable to maintain altitude: effect of altitude on power available;

(F) effects on performance;

(G) effects on power available and power required;

(H) effects on various airframe configuration and propeller settings;

(I) use of flight manual or equivalent document (for example owner's manual or pilot's operating handbook):

(a) cruising;

(b) climbing: ASI colour coding (blue line);

(c) descending;

(d) turning.

(J) 'live' engine limitations and handling;

(K) take-off and approach: control and performance.

(33) Significant factors:

(i) significance of take-off safety speed:

(A) effect of landing gear, flap, feathering, take-off, trim setting, systems for operating landing gear and flaps;

(B) effect on mass, altitude and temperature (performance).

(ii) significance of best SE climb speed (V_{yse}):

(A) acceleration to best engine climb speed and establishing a positive climb;

(B) relationship of SE climb speed to normal climb speed;

(C) action if unable to climb.

(iii) significance of asymmetric committal height and speed: action if baulked below asymmetric committal height.

(34) Engine failure during take-off:

(i) below v_{mca} or unstick speed:

(A) accelerate or stop distance considerations;

(B) prior use of flight manual data if available.

(ii) above v_{mca} or unstick speed and below safety speed;

(iii) immediate re-landing or use of remaining power to achieve forced landing;

(iv) considerations:

(A) degree of engine failure;

(B) speed at the time;

(C) mass, altitude and temperature (performance);

(D) configuration;

(E) length of runway remaining;

(F) position of any obstacles ahead.

(35) Engine failure after take-off:

(i) simulated at a safe height and at or above take-off safety speed;

(ii) considerations:

(A) need to maintain control;

(B) use of bank towards operating engine;

(C) use of available power achieving best SE climb speed;

(D) mass, altitude, temperature (performance);

(E) effect of prevailing conditions and circumstances.

(36) Immediate actions: maintenance of control, including air speed and use of power:

(i) recognition of asymmetric condition;

(ii) identification and confirmation of failed engine;

(iii) feathering and removal of drag (procedure for type);

(iv) establishing best SE climb speed.

(37) Subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(i) cause and fire check;

(ii) live engine, handling considerations;

(iii) remaining services;

(iv) ATC liaison;

(v) fuel management.

Note: these procedures are applicable to aeroplane type and flight situation.

(38) Significance of asymmetric committal height:

(i) Asymmetric committal height is the minimum height needed to establish a positive climb whilst maintaining adequate speed for control and removal of drag during an approach to a landing.

Because of the significantly reduced performance of many CS/JAR/FAR 23 aeroplanes when operating on one engine, consideration is to be given to a minimum height from which it would be safely possible to attempt a go-around procedure, during an approach when the flight path will have to be changed from a descent to a climb with the aeroplane in a high drag configuration.

Due to the height loss which will occur during the time that the operating engine is brought up to full power, landing gear and flap retracted, and the aeroplane established in a climb at v_{yse} a minimum height (often referred to as 'Asymmetric committal height') is to be selected, below which the pilot should not attempt to take the aeroplane round again for another circuit. This height will be compatible with the aeroplane type, all up weight, altitude of the aerodrome being used, air temperature, wind, the height of obstructions along the climb out path, and pilot competence.

(ii) circuit approach and landing on asymmetric power:

(A) definition and use of asymmetric committal height;

(B) use of standard pattern and normal procedures;

(C) action if unable to maintain circuit height;

(D) speed and power settings required;

(E) decision to land or go-around at asymmetric committal height: factors to be considered.

(iii) undershooting importance of maintaining correct air speed (not below v_{yse}).

(39) Speed and heading control:

(i) height, speed and power relationship: need for minimum possible drag;

(ii) establishing positive climb at best SE rate of climb speed:

(A) effect of availability of systems, power for flap and landing gear;

(B) operation and rapid clean up.

Note 1: The air speed at which the decision is made to commit the aeroplane to a landing or to go-around should normally be the best SE rate of climb speed and in any case not less than the safety speed.

Note 2: On no account should instrument approach 'decision height' and its associated procedures be confused with the selection of minimum height for initiating a go-around in asymmetric power flight.

(40) Engine failure during an all engines approach or missed approach:

(i) use of asymmetric committal height and speed considerations;

(ii) speed and heading control;

(iii) decision to attempt a landing, go-around or force land as circumstances dictate.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(41) Instrument flying on asymmetric power:

(i) considerations relating to aircraft performance during:

(A) straight and level flight;

(B) climbing and descending;

(C) standard rate turns;

(D) level, climbing and descending turns including turns onto pre-selected headings.

(ii) availability of vacuum operated instruments;

(iii) availability of electrical power source.

(b) Air exercise

This section covers the operation of a SP ME aeroplane when one engine has failed and it is applicable to all such light piston aeroplanes. Checklists should be used as applicable.

(1) introduction to asymmetric flight:

(2) close the throttle of one engine;

(3) feather its propeller;

(4) effects on aeroplane handling at cruising speed;

(5) effects on aeroplane performance for example cruising speed and rate of climb;

(6) note foot load to maintain a constant heading;

(7) un-feather the propeller;

(8) return to normal flight finding the zero thrust throttle setting;

(9) comparison of foot load when feathered and with zero thrust set.

(10) effects and recognition of engine failure in level flight with the aeroplane straight and level at cruise speed:

(i) slowly close the throttle of one engine;

(ii) note yaw, roll and spiral descent.

(11) return to normal flight:

(i) close throttle of other engine;

(ii) note same effects in opposite direction.

(12) methods of control and identification of failed engine close one throttle and maintain heading and level flight by use of:

(i) rudder to control yaw;

(ii) aileron to hold wings level;

(iii) elevators to maintain level flight;

(iv) power (as required) to maintain air speed and altitude.

(13) alternative or supplementary method of control:

(i) simultaneously;

(ii) lower aeroplane nose to increase air speed;

(iii) reduce power;

(iv) loss of altitude: inevitable.

(14) identification of failed engine: idle foot = idle engine;

(15) use of instruments for identification:

(i) fuel pressure or fuel flow;

(ii) RPM gauge or CSU action may mask identification;

(iii) engine temperature gauges.

(16) confirmation of identification: close the throttle of the identified failed engine;

(17) effects and recognition of engine failure in turns and effects of 'inside' engine failure:

(i) more pronounced yaw;

(ii) more pronounced roll;

(iii) more pronounced pitch down.

(18) effects of 'outside' engine failure:

(i) less pronounced yaw;

(ii) less pronounced roll;

(iii) less pronounced pitch down.

(19) possibility of confusion in identification:

(i) use of correct rudder application;

(ii) return to lateral level flight if necessary.

(20) flight instrument indications;

(21) effect of varying speed and power;

(22) failure of one engine at cruise speed and power: engine failure clearly recognised;

(23) failure of one engine at low speed and high power (not below v_{sse}): engine failure most positively recognised;

(24) failure of one engine at higher speeds and low power: possible failure to recognise engine failure;

(25) minimum control speeds;

(26) establish the v_{yse}:

(i) select maximum permitted manifold pressure and RPM;

(ii) close the throttle on one engine;

(iii) raise the aeroplane nose and reduce the air speed;

(iv) note the air speed when maximum rudder deflection is being applied and when directional control can no longer be maintained;

(v) lower the aeroplane nose and reduce power until full directional control is regained;

(vi) the lowest air speed achieved before the loss of directional control will be the V_{mc} for the flight condition;

(vii) repeat the procedure closing the throttle of the other engine;

(viii) the higher of these two air speeds will identify the most critical engine to fail.

Note: warning - in the above situations the recovery is to be initiated immediately before directional control is lost with full rudder applied, or when a safe margin above the stall remains, for example when the stall warning device operates, for the particular aeroplane configuration and flight conditions. On no account should the aeroplane be allowed to decelerate to a lower air speed.

(27) establish the effect of using 5 ° of bank at v_{mc}:

(i) close the throttle of one engine;

(ii) increase to full power on the operating engine;

(iii) using 5 ° of bank towards the operating engine reduce speed to the $V_{mc;}$

(iv) note lower V_{mc} when 5 ° of bank is used.

(28) 'in-flight' engine failure procedure;

(29) in cruise and other flight circumstances not including take-off and landing.

(30) Immediate actions: maintenance of control including air speed and use of power:

(i) identification and confirmation of failed engine;

(ii) failure cause and fire check;

(iii) feathering decision and implementation;

(iv) reduction of any other drag, for example flaps, cowl flaps etc.;

(v) retrim and maintain altitude.

(31) Subsequent actions:

(i) live engine:

(A) oil temperature, pressure, fuel flow and power;

(B) remaining services;

(C) electrical load: assess and reduce as necessary;

(D) effect on power source for air driven instruments;

(E) landing gear;

(F) flaps and other services.

(ii) re-plan flight:

(A) ATC and weather;

(B) terrain clearance;

(C) SE cruise speed;

(D) decision to divert or continue;

(iii) fuel management: best use of fuel;

(iv) dangers of re-starting damaged engine;

(v) action if unable to maintain altitude:

(A) adopt V_{yse};

(B) effect of altitude on power available.

(vi) effects on performance;

(vii) effects on power available and power required;

(viii) effects on various airframe configurations and propeller settings;

(ix) use of flight manual or equivalent document (for example owner's manual or pilot's operating handbook):

(A) cruising;

(B) climbing: ASI colour coding (blue line);

(C) descending;

(D) turning.

(x) 'live' engine limitations and handling;

(xi) take-off and approach: control and handling;

Note: to be done at a safe height away from the circuit;

(xii) take-off case with landing gear down and take-off flap set (if applicable);

(xiii) significance of take-off at or above safety speed (at safety speed. The ability to maintain control and to accelerate to SE climb speed with aeroplane clean and zero thrust set. Thereafter to achieve a positive climb);

(xiv) significance of flight below safety speed (below safety speed and above v_{mca}. A greater difficulty to maintain control, a possible loss of height whilst maintaining speed, cleaning up, accelerating to SE climb speed and establishing a positive climb);

(xv) significance of best SE climb speed (the ability to achieve the best rate of climb on one engine with minimum delay).

(32) Significance of asymmetric committal height:

(i) the ability to maintain or accelerate to the best SE rate of climb speed and to maintain heading whilst cleaning up with perhaps a slight height loss before climbing away;

(ii) below this height, the aeroplane is committed to continue the approach to a landing.

(33) Engine failure during take-off run and below safety speed briefing only;

(34) Engine failure after take-off;

Note: to be initiated at a safe height and at not less than take-off safety speed with due regard to the problems of a prolonged SE climb in the prevailing conditions.

(i) immediate actions:

(A) control of direction and use of bank;

(B) control of air speed and use of power;

(C) recognition of asymmetric condition;

(D) identification and confirmation of failed engine feathering and reduction of drag (procedure for type);

(E) re-trim;

(ii) subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(A) cause and fire check;

(B) live engine, handling considerations;

(C) drills and procedures applicable to aeroplane type and flight situation;

(D) ATC liaison;

(E) fuel management.

(35) Asymmetric circuit, approach and landing;

(i) downwind and base legs:

(A) use of standard pattern;

(B) normal procedures;

(C) landing gear and flap lowering considerations;

(D) position for base leg;

(E) live engine handling;

(F) air speed and power settings;

(G) maintenance of height.

(ii) final approach:

(A) asymmetric committal height drill;

(B) control of air speed and descent rate;

(C) flap considerations.

(iii) going round again on asymmetric power (missed approach):

(A) not below asymmetric committal height;

(B) speed and heading control;

(C) reduction of drag, landing gear retraction;

(D) maintaining V_{yse};

(E) establish positive rate of climb.

(36) Engine failure during all engines approach or missed approach:

Note: to be started at not less than asymmetric committal height and speed and not more than part flap set:

(i) speed and heading control;

(ii) reduction of drag flap;

(iii) decision to attempt landing or go-around;

(iv) control of descent rate if approach is continued;

(v) if go-around is initiated, maintain v_{yse}, flaps and landing gear retracted and establish positive rate of climb.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(37) Instrument flying on asymmetric power;

(38) Flight instrument checks and services available:

(i) straight and level flight;

(ii) climbing and descending;

(iii) standard rate turns;

(iv) level, climbing and descending turns including turns onto pre-selected headings.

FCL.940.CRI CRI — Revalidation and renewal

(a) For revalidation of a CRI certificate the applicant shall, within the 12 months preceding the expiry date of the CRI certificate:

(1) conduct at least 10 hours of flight instruction in the role of a CRI. If the applicant has CRI privileges on both single-engine and multi-engine aeroplanes, the 10 hours of flight instruction shall be equally divided between single-engine and multi-engine aeroplanes; or

(2) receive refresher training as a CRI at an ATO; or

(3) pass the assessment of competence in accordance with FCL.935 for multi-engine or single-engine aeroplanes, as relevant.

(b) For at least each alternate revalidation of a CRI certificate, the holder shall have to comply with the requirement of (a)(3).

(c) Renewal. If the CRI certificate has lapsed, the applicant shall, within a period of 12 months before renewal:

(1) receive refresher training as a CRI at an ATO;

(2) pass the assessment of competence established in FCL.935.

AMC1 FCL.940.CRI CRI — Revalidation and renewal

REFRESHER TRAINING

(a) Paragraph (c)(1) of FCL.940.CRI determine that an applicant for renewal of a CRI certificate shall complete refresher training as a CRI at an ATO. Paragraph (a)(2) also establishes that an applicant for revalidation of the CRI certificate that has not completed a minimum amount of instruction hours (established in paragraph (a)(1)) during the validity period of the certificate shall undertake refresher training at an ATO for the revalidation of the certificate. The amount of refresher training needed should be determined on a case by case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant;

(2) whether the training is for revalidation or renewal;

(3) the amount of time lapsed since the last time the applicant has conducted training, in the case of revalidation, or since the certificate has lapsed, in the case of renewal. The amount of training needed to reach the desired level of competence should increase with the time lapsed.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme that should be based on the CRI training course and focus on the aspects where the applicant has shown the greatest needs.

SECTION 6 - Specific requirements for the instrument rating instructor — IRI

FCL.905.IRI IRI — Privileges and conditions

(a) The privileges of an IRI are to instruct for the issue, revalidation and renewal of an EIR or an IR on the appropriate aircraft category.

(b) Specific requirements for the MPL course. To instruct for the basic phase of training on an MPL course, the IRI(A) shall:

(1) hold an IR for multi-engine aeroplanes; and

(2) have completed at least 1 500 hours of flight time in multi-crew operations.

(3) In the case of IRI already qualified to instruct on ATP(A) or CPL(A)/IR integrated courses, the requirement of (b)(2) may be replaced by the completion of the course provided for in paragraph FCL.905.FI(j)(3).

FCL.915.IRI IRI — Prerequisites

An applicant for an IRI certificate shall:

(a) for an IRI(A):

(1) have completed at least 800 hours of flight time under IFR, of which at least 400 hours shall be in aeroplanes; and

(2) in the case of applicants of an IRI(A) for multi-engine aeroplanes, meet the requirements of paragraphs FCL.915.CRI(a), FCL.930.CRI and FCL.935;

(b) for an IRI(H):

(1) have completed at least 500 hours of flight time under IFR, of which at least 250 hours shall be instrument flight time in helicopters; and

(2) in the case of applicants for an IR(H) for multi-pilot helicopters, meet the requirements of FCL.905.FI(g)(3)(ii);

(c) for an IRI(As), have completed at least 300 hours of flight time under IFR, of which at least 100 hours shall be instrument flight time in airships.

FCL.930.IRI IRI — Training course

(a) The training course for the IRI shall include, at least:

(1) 25 hours of teaching and learning instruction;

(2) 10 hours of technical training, including revision of instrument theoretical knowledge, the preparation of lesson plans and the development of classroom instructional skills;

(3)

(i) for the IRI(A), at least 10 hours of flight instruction on an aeroplane, FFS, FTD 2/3 or FPNT II. In the case of applicants holding an FI(A) certificate, these hours are reduced to 5;

(ii) for the IRI(H), at least 10 hours of flight instruction on a helicopter, FFS, FTD 2/3 or FNPT II/III;

(iii) for the IRI(As), at least 10 hours of flight instruction on an airship, FFS, FTD 2/3 or FNPT II.

(b) Flight instruction shall be given by an FI qualified in accordance with FCL.905.FI(i).

(c) Applicants holding or having held an instructor certificate shall be fully credited towards the requirement of (a)(1).

AMC1 FCL.930.IRI IRI— Training course

GENERAL

(a) The aim of the IRI training course is to train aircraft licence holders to the level of competence defined in FCL.920, and adequate for an IRI.

(b) The IRI training course should give particular stress to the role of the individual in relation to the importance of human factors in the man-machine environment.

(c) Special attention should be paid to the applicant's levels of maturity and judgement including an understanding of adults, their behavioural attitudes and variable levels of education.

(d) With the exception of the section on 'teaching and learning', all the subject detail contained in the theoretical and flight training syllabus is complementary to the instrument rating pilot course syllabus which should already be known by the applicant. Therefore, the objective of the course is to:

(1) refresh and bring up to date the technical knowledge of the student instructor;

(2) train pilots in accordance with the requirements of the modular instrument flying training course;

(3) enable the applicant to develop the necessary instructional techniques required for teaching of instrument flying, radio navigation and instrument procedures to the level required for the issue of an instrument rating;

(4) ensure that the student instrument rating instructor's flying is of a sufficiently high standard.

(e) In part 3 some of the air exercises of the flight instruction syllabus of this AMC may be combined in the same flight.

(f) During the training course the applicants should be made aware of their own attitudes to the important aspects of flight safety. Improving safety awareness should be a fundamental objective throughout the training course. It will be of major importance for the training course to aim at giving applicants the knowledge, skills and attitudes relevant to an instructor's task. To achieve this, the course curriculum, in terms of objectives, should comprise at least the following areas.

(g) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(h) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(i) The training course consists of three parts:

(1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920.

(2) Part 2: instrument technical theoretical knowledge instruction (technical training).

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The instrument theoretical knowledge instruction should comprise not less than 10 hours training to include the revision of instrument theoretical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the IRI to instruct the instrument theoretical knowledge syllabus.

(b) All the subject detail contained in the instrument theoretical knowledge instruction syllabus and flight instruction syllabus is complementary to the instrument rating pilot course syllabus which should already be known by the applicant. Therefore, the objective of the course is to:

(1) refresh and bring up to date the technical knowledge of the student instructor;

(2) train pilots in accordance with the requirements of the modular instrument flying training course;

(3) enable the applicant to develop the necessary instructional techniques required for teaching of instrument flying, radio navigation and instrument procedures to the level required for the issue of an instrument rating; and

(4) ensure that the student instrument rating instructor's flying is of a sufficiently high standard.

(c) The theoretical subjects covered below should be used to develop the instructor's teaching skills. The items selected should relate to the student's background and should be applied to training for an IR.

GENERAL SUBJECTS

(d) Physiological and psychological factors:

(1) the senses;

(2) spatial disorientation;

(3) sensory illusions;

(4) stress.

(e) Flight instruments:

(1) air speed indicator;

(2) altimeter;

(3) vertical speed indicator;

(4) attitude indicator;

(5) heading indicator;

(6) turn and slip indicator;

(7) magnetic compass;

(8) in relation to the above instruments the following items should be covered:

(i) principles of operation;

(ii) errors and in-flight serviceability checks;

(iii) system failures.

(f) Radio navigation aids:

(1) basic radio principles;

(2) use of VHF RTF channels;

(3) the Morse code;

(4) basic principles of radio aids;

(5) use of VOR;

(6) ground and aeroplane equipment;

(7) use of NDB/ADF;

(8) ground and aeroplane equipment;

(9) use of VHF/DF;

(10) radio detection and ranging (radar);

(11) ground equipment;

(12) primary radar;

(13) secondary surveillance radar;

(14) aeroplane equipment;

(15) transponders;

(16) precision approach system;

(17) other navigational systems (as applicable) in current operational use;

(18) ground and aeroplane equipment;

(19) use of DME;

(20) ground and aeroplane equipment;

(21) marker beacons;

(22) ground and aeroplane equipment;

(23) pre-flight serviceability checks;

(24) range, accuracy and limitations of equipment.

(g) Flight planning considerations;

(h) Aeronautical information publications:

(1) the training course should cover the items listed below, but the applicant's aptitude and previous aviation experience should be taken into account when determining the amount of instructional time allotted. Although a number of items contained under this heading are complementary to those contained in the PPL/CPL/IR syllabi, the instructor should ensure that they have been covered during the applicant's training and due allowance should be made for the time needed to revise these items as necessary.

(2) AIP

(3) NOTAM class 1 and 2;

(4) AIC;

(5) information of an operational nature;

(6) the rules of the air and ATS;

(7) visual flight rules and instrument flight rules;

(8) flight plans and ATS messages;

(9) use of radar in ATS;

(10) radio failure;

(11) classification of airspace;

(12) airspace restrictions and hazards;

(13) holding and approach to land procedures;

(14) precision approaches and non precision approaches;

(15) radar approach procedures;

(16) missed approach procedures;

(17) visual manoeuvring after an instrument approach;

(18) conflict hazards in uncontrolled airspace;

(19) communications;

(20) types of services;

(21) extraction of AIP data relating to radio aids;

(22) charts available;

(23) en-route;

(24) departure and arrival;

(25) instrument approach and landing;

(26) amendments, corrections and revision service.

(i) flight planning general:

(1) the objectives of flight planning;

(2) factors affecting aeroplane and engine performance;

(3) selection of alternate(s);

(4) obtaining meteorological information;

(5) services available;

(6) meteorology briefing;

(7) telephone or electronic data processing;

(8) actual weather reports (TAFs, METARs and SIGMET messages);

(9) the route forecast;

(10) the operational significance of the meteorological information obtained (including icing, turbulence and visibility);

(11) altimeter considerations;

(12) definitions of:

(i) transition altitude;

(ii) transition level;

(iii) flight level;

(iv) QNH;

(v) regional QNH;

(vi) standard pressure setting;

(vii) QFE.

(13) altimeter setting procedures;

(14) pre-flight altimeter checks;

(15) take-off and climb;

(16) en-route;

(17) approach and landing;

(18) missed approach;

(19) terrain clearance;

(20) selection of a minimum safe en-route altitude;

(21) IFR;

(22) preparation of charts;

(23) choice of routes and flight levels;

(24) compilation of flight plan or log sheet;

(25) log sheet entries;

(26) navigation ground aids to be used;

(27) frequencies and identification;

(28) radials and bearings;

(29) tracks and fixes;

(30) safety altitude(s);

(31) fuel calculations;

(32) ATC frequencies (VHF);

(33) tower, approach, en-route, radar, FIS, ATIS, and weather reports;

(34) minimum sector altitudes at destination and alternate aerodromes;

(35) determination of minimum safe descent heights or altitudes (decision heights) at destination and alternate aerodromes.

(j) The privileges of the instrument rating:

(1) outside controlled airspace;

(2) within controlled airspace;

(3) period of validity and renewal procedures.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) An approved IRI course should comprise of at least 10 hours of flight instruction, of which a maximum of 8 hours may be conducted in an FSTD. A similar number of hours should be used for the instruction and practice of pre-flight and post-flight briefing for each exercise.

(b) The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently.

A. AEROPLANES

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INTRUMENT FLYING (Basic)

(for revision, as deemed necessary by the instructor)

(a) Long briefing objectives:

(1) flight instruments;

(2) physiological considerations;

(3) instrument appreciation:

(i) attitude instrument flight;

(ii) pitch indications;

(iii) bank indications;

(iv) different instrument presentations;

(v) introduction to the use of the attitude indicator;

(vi) pitch attitude;

(vii) bank attitude;

(viii) maintenance of heading and balanced flight;

(ix) instrument limitations (inclusive system failures).

(4) attitude, power and performance:

(i) attitude instrument flight;

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power and configuration;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan.

(5) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

(b) Air exercise:

(1) instrument flying (basic);

(i) physiological sensations;

(ii) instrument appreciation;

(iii) attitude instrument flight;

(iv) pitch attitude;

(v) bank attitude;

(vi) maintenance of heading and balanced flight;

(vii) attitude instrument flight;

(viii) effect of changing power and configuration;

(ix) cross-checking the instruments;

(x) selective radial scan;

(2) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

EXERCISE 2: INTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

(1) full panel;

(2) 30 ° level turns;

(3) unusual attitudes: recoveries;

(4) transference to instruments after take-off;

(5) limited panel;

(6) basic flight manoeuvres;

(7) unusual attitudes: recoveries.

(b) Air exercise:

(1) full panel;

(2) 30 ° level turns;

(3) unusual attitudes: recoveries;

(4) limited panel;

(5) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

(1) availability of VOR stations en-route;

(2) station frequencies and identification;

(3) signal reception range;

(4) effect of altitude;

(5) VOR radials;

(6) use of OBS;

(7) to or from indicator;

(8) orientation;

(9) selecting radials;

(10) intercepting a pre-selected radial;

(11) assessment of distance to interception;

(12) effects of wind;

(13) maintaining a radial;

(14) tracking to and from a VOR station;

(15) procedure turns;

(16) station passage;

(17) use of two stations for obtaining a fix;

(18) pre-selecting fixes along a track;

(19) assessment of ground speed and timing;

(20) holding procedures;

(21) various entries;

(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) station selection and identification;

(2) orientation;

(3) intercepting a pre-selected radial;

(4) R/T procedures and ATC liaison;

(5) maintaining a radial inbound;

(6) recognition of station passage;

(7) maintaining a radial outbound;

(8) procedure turn;

(9) use of two stations to obtain a fix along the track;

(10) assessment of ground speed and timing;

(11) holding procedures and entries;

(12) holding at a pre-selected fix;

(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF NDB

(a) Long briefing objectives:

(1) availability of an NDB facilities en-route;

(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;

(4) static interference;

(5) night effect;

(6) station interference;

(7) mountain effect;

(8) coastal refraction;

(9) orientation in relation to an NDB;

(10) homing;

(11) intercepting a pre-selected magnetic bearing and tracking inbound;

(12) station passage;

(13) tracking outbound;

(14) time and distance checks;

(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;

(16) holding procedures and various approved entries;

(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) selecting, tuning and identifying an NDB;

(2) ADF orientation;

(3) communication (R/T procedures and ATC liaison);

(4) homing;

(5) tracking inbound;

(6) station passage;

(7) tracking outbound;

(8) time and distance checks;

(9) intercepting a pre-selected magnetic bearing;

(10) determining the aeroplane's position from two NDBs or alternatively from one NDB and one other navaid;

(11) ADF holding procedures and various approved entries.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:

(1) availability of VHF/DF facilities en-route;

(2) location, frequencies, station call signs and hours of operation;

(3) signal and reception range;

(4) effect of altitude;

(5) communication (R/T procedures and ATC liaison);

(6) obtaining and using types of bearings, for example QTE, QDM and QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T Procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix.

(b) Air exercise:

(1) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS (SSR)

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMs;

(4) provision of service;

(5) communication (R/T, procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL PROCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the aeroplane radio;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:
   (1) radio equipment serviceability checks;
   (2) departure clearance;
   (3) navaid selection;
   (4) frequencies, radials, etc.;
   (5) aerodrome departure checks, frequency changes, altitude and position reports;
   (6) SID procedures.

EXERCISE 10: INSTRUMENT APPORACH: ILS APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURE

(a) Long briefing objectives:
   (1) precision approach charts;
   (2) approach to the initial approach fix and minimum sector altitude;
   (3) navaid requirements, for example radar, ADF, etc.;
   (4) communication (ATC liaison and R/T phraseology);
   (5) holding procedure;
   (6) the final approach track;
   (7) forming a mental picture of the approach;
   (8) completion of aerodrome approach checks;
   (9) initial approach procedure;
   (10) selection of the ILS frequency and identification;
   (11) obstacle clearance altitude or height;
   (12) operating minima;
   (13) achieving the horizontal and vertical patterns;
   (14) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;
   (15) use of DME (as applicable);
   (16) go-around and missed approach procedure;
   (17) review of the published instructions;
   (18) transition from instrument to visual flight (sensory illusions);
   (19) visual manoeuvring after an instrument approach:
      (i) circling approach;
      (ii) visual approach to landing.
(b) Air exercise:
   (1) initial approach to the ILS;
   (2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of runway lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface and the length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localiser and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height;

(17) runway direction;

(18) overshoot and missed approach procedure;

(19) transition from instrument to visual flight;

(20) circling approach;

(21) visual approach to landing.

EXERCISE 11: INSTRUMENTS APPROACH: NDB APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning;

(6) holding procedure;

(7) the approach track;

(8) forming a mental picture of the approach;

(9) initial approach procedure;

(10) operating minima;

(11) completion of approach planning;

(12) achieving the horizontal and vertical patterns;

(13) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(14) use of DME (as applicable);

(15) go-around and missed approach procedure;

(16) review of the published instructions;

(17) transition from instrument to visual flight (sensory illusions);

(18) visual manoeuvring after an instrument approach;

(19) circling approach;

(20) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning including determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(2) circling approach;

(3) go-around and missed approach procedure;

(4) initial approach;

(5) frequency selection and identification;

(6) review of the published procedure and minimum safe sector altitude;

(7) ATC liaison and R/T phraseology;

(8) determination of decision height and altimeter setting;

(9) weather considerations, for example cloud base and visibility;

(10) availability of runway lighting;

(11) determination of inbound track;

(12) assessment of time from final approach fix to the missed approach point;

(13) ATC liaison;

(14) the outbound procedure (inclusive completion of pre-landing checks);

(15) the inbound procedure;

(16) re-check of identification code;

(17) altimeter setting re-checked;

(18) the final approach;

(19) note time and establish air speed and descent rate;

(20) maintaining the final approach track;

(21) anticipation of change in wind velocity and its effect on the drift;

(22) minimum descent altitude or height;

(23) runway direction;

(24) go-around and missed approach procedure;

(25) transition from instrument to visual flight (sensory illusions);

(26) visual approach.

EXERCISE 12: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF GNSS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

B. HELICOPTERS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INSTRUMENT FLYING (Basic)
(for revision as deemed necessary by the instructor)

(a) Long briefing objectives:

(1) flight instruments;

(2) physiological considerations;

(3) instrument appreciation:

(i) attitude instrument flight;

(ii) pitch indications;

(iii) bank indications;

(iv) different instrument presentations;

(v) introduction to the use of the attitude indicator;

(vi) pitch attitude;

(vii) bank attitude;

(viii) maintenance of heading and balanced flight;

(ix) instrument limitations (inc. system failures);

(4) attitude, power and performance:

(i) attitude instrument flight;

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan;

(5) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

(b) Air exercise:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) pitch attitude;

(5) bank attitude;

(6) maintenance of heading and balanced flight;

(7) attitude instrument flight;

(8) effect of changing power;

(9) cross-checking the instruments;

(10) selective radial scan;

(11) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and helicopter configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings;

(vi) manoeuvring at minimum and maximum IMC speed.

EXERCISE 2: INSTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

(1) full panel;

(2) 30° level turns;

(3) unusual attitudes: recoveries;

(4) transition to instruments after take-off;

(5) limited panel;

(6) basic flight manoeuvres;

(7) unusual attitudes: recoveries.

(b) Air exercise:

(1) full panel;

(2) 30° level turns;

(3) unusual attitudes: recoveries;

(4) identification and recovery from low pitch steep bank and high pitch steep bank attitudes (at low and high power settings);

(5) limited panel;

(6) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

(1) availability of VOR stations en-route;

(2) station frequencies and identification;

(3) signal reception range;

(4) effect of altitude;

(5) VOR radials;

(6) use of OBS;

(7) to and from indicator;

(8) orientation;

(9) selecting radials;

(10) intercepting a pre-selected radial;

(11) assessment of distance to interception;

(12) effects of wind;

(13) maintaining a radial;

(14) tracking to and from a VOR station;

(15) procedure turns;

(16) station passage;

(17) use of two stations for obtaining a fix;

(18) pre-selecting fixes along a track;

(19) assessment of ground speed and timing;

(20) holding procedures;

(21) various entries;

(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) station selection and identification;

(2) orientation;

(3) intercepting a pre-selected radial;

(4) R/T procedures and ATC liaison;

(5) maintaining a radial inbound;

(6) recognition of station passage;

(7) maintaining a radial outbound;

(8) procedure turns;

(9) use of two stations to obtain a fix along the track;

(10) assessment of ground speed and timing;

(11) holding procedures and entries;

(12) holding at a pre-selected fix;

(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF NDB

(a) Long briefing objectives:

(1) availability of NDB facilities en-route;

(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;

(4) static interference;

(5) night effect;

(6) station interference;

(7) mountain effect;

(8) coastal refraction;

(9) orientation in relation to an NDB;

(10) homing;

(11) intercepting a pre-selected magnetic bearing and tracking inbound;

(12) station passage;

(13) tracking outbound;

(14) time and distance checks;

(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;

(16) holding procedures;

(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) selecting, tuning and identifying an NDB;

(2) ADF orientation;

(3) communication (R/T procedures and ATC liaison);

(4) homing;

(5) tracking inbound;

(6) station passage;

(7) tracking outbound;

(8) time and distance checks;

(9) intercepting a pre-selected magnetic bearing;

(10) determining the helicopter's position from two NDBs or alternatively from one NDB and one other navaid;

(11) ADF holding procedures.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:

(1) availability of VHF/DF facilities en-route;

(2) location, frequencies, station call signs and hours of operation;

(3) signal and reception range;

(4) effect of altitude;

(5) communication (R/T procedures and ATC liaison);

(6) obtaining and using types of bearings, for example QTE, QDM, QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix;

(b) Air exercise:

(4) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR SERVICES

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMS;

(4) provision of service;

(5) communication (R/T procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL POOCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the radio equipment;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:

(1) radio equipment serviceability checks;

(2) departure clearance;

(3) navaid selection;

(4) frequencies, radials, etc.;

(5) aerodrome departure checks, frequency changes, altitude and position reports;

(6) SID procedures.

EXERCISE 10: INSTRUMENT APPROACH: PRECISION APPROACH AID TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) precision approach charts;

(2) approach to the initial approach fix and minimum sector altitude;

(3) navaid requirements, for example radar, ADF, etc.;

(4) communication (ATC liaison and R/T phraseology);

(5) holding procedure;

(6) the final approach track;

(7) forming a mental picture of the approach;

(8) completion of aerodrome approach checks;

(9) initial approach procedure;

(10) selection of the ILS frequency and identification;

(11) obstacle clearance altitude or height;

(12) operating minima;

(13) achieving the horizontal and vertical patterns;

(14) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(15) use of DME (as applicable);

(16) go-around and missed approach procedure;

(17) review of the published instructions;

(18) transition from instrument to visual flight (sensory illusions);

(19) visual manoeuvring after an instrument approach;

(i) circling approach;

(ii) visual approach to landing.

(b) Air exercise:

(1) initial approach to the ILS;

(2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of landing site lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface and the length of the landing site;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localizer and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height.

(17) landing direction;

(18) go-around and missed approach procedure;

(19) transition from instrument to visual flight;

(20) circling approach;

(21) visual approach to landing.

EXERCISE 11: INSTRUMENT APPROACH: NON-PRECISION APPROACH TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning;

(6) holding procedure;

(7) the approach track;

(8) forming a mental picture of the approach;

(9) initial approach procedure;

(10) operating minima;

(11) completion of approach planning;

(12) achieving the horizontal and vertical patterns;

(13) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(14) use of DME (as applicable);

(15) go-around and missed approach procedure;

(16) review of the published instructions;

(17) transition from instrument to visual flight (sensory illusions);

(18) visual manoeuvring after an instrument approach;

(19) circling approach;

(20) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning, including determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing site;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach.

(2) circling approach;

(3) go-around and missed approach procedure;

(4) initial approach;

(5) frequency selection and identification;

(6) review of the published procedure and minimum safe sector altitude;

(7) ATC liaison and R/T phraseology;

(8) determination of decision height and altimeter setting;

(9) weather considerations, for example cloud base and visibility;

(10) availability of landing site lighting;

(11) determination of inbound track;

(12) assessment of time from final approach fix to the missed approach point;

(13) ATC liaison;

(14) the outbound procedure (incl. completion of pre-landing checks);

(15) the inbound procedure;

(16) re-check of identification code;

(17) altimeter setting re-checked;

(18) the final approach;

(19) note time and establish air speed and descent rate;

(20) maintaining the final approach track;

(21) anticipation of change in wind velocity and its effect on the drift;

(22) minimum descent altitude or height;

(23) landing site direction;

(24) go-around and missed approach procedure;

(25) transition from instrument to visual flight (sensory illusions);

(26) visual approach.

EXERCISE 12: USE OF GNSS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

C. AIRSHIPS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INSTRUMENT FLYING (Basic)

(for revision as deemed necessary by the instructor)

(a) Long briefing objectives:

(1) flight instruments;

(2) physiological considerations;

(3) instrument appreciation:

(i) attitude instrument flight;

(ii) pitch indications;

(iii) different instrument presentations;

(iv) introduction to the use of the attitude indicator;

(v) pitch attitude;

(vi) maintenance of heading and balanced flight;

(vii) instrument limitations (inclusive system failures).

(4) attitude, power and performance:

(i) attitude instrument flight;

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power, trim and configuration;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan.

(5) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and airship configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

(b) Air exercise:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) pitch attitude;

(5) bank attitude;

(6) maintenance of heading and balanced flight;

(7) attitude instrument flight;

(8) effect of changing power and configuration;

(9) cross-checking the instruments;

(10) selective radial scan;

(11) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and airship configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

EXERCISE 2: INSTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

(1) full panel;

(2) unusual attitudes: recoveries;

(3) transference to instruments after take-off;

(4) limited panel;

(5) basic flight manoeuvres;

(6) unusual attitudes: recoveries.

(b) Air exercise:

(1) full panel;

(2) unusual attitudes: recoveries;

(3) limited panel;

(4) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

(1) availability of VOR stations en-route;

(2) station frequencies and identification;

(3) signal reception range;

(4) effect of altitude;

(5) VOR radials;

(6) use of OBS;

(7) to or from indicator;

(8) orientation;

(9) selecting radials;

(10) intercepting a pre-selected radial;

(11) assessment of distance to interception;

(12) effects of wind;

(13) maintaining a radial;

(14) tracking to and from a VOR station;

(15) procedure turns;

(16) station passage;

(17) use of two stations for obtaining a fix;

(18) pre-selecting fixes along a track;

(19) assessment of ground speed and timing;

(20) holding procedures;

(21) various entries;

(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) station selection and identification;

(2) orientation;

(3) intercepting a pre-selected radial;

(4) R/T procedures and ATC liaison;

(5) maintaining a radial inbound;

(6) recognition of station passage;

(7) maintaining a radial outbound;

(8) procedure turns;

(9) use of two stations to obtain a fix along the track;

(10) assessment of ground speed and timing;

(11) holding procedures and entries;

(12) holding at a pre-selected fix;

(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF ADF

(Automatic DF equipment)

(a) Long briefing objectives:

(1) availability of NDB facilities en-route;

(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;

(4) static interference;

(5) night effect;

(6) station interference;

(7) mountain effect;

(8) coastal refraction;

(9) orientation in relation to an NDB;

(10) homing;

(11) intercepting a pre-selected magnetic bearing and tracking inbound;

(12) station passage;

(13) tracking outbound;

(14) time and distance checks;

(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;

(16) holding procedures and various approved entries;

(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) selecting, tuning and identifying an NDB;

(2) ADF orientation;

(3) communication (R/T procedures and ATC liaison);

(4) homing;

(5) tracking inbound;

(6) station passage;

(7) tracking outbound;

(8) time and distance checks;

(9) intercepting a pre-selected magnetic bearing;

(10) determining the airship's position from two NDBs or alternatively from one NDB and one other navaid;

(11) ADF holding procedures and various approved entries.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:

(1) availability of VHF/DF facilities en-route;

(2) location, frequencies, station call signs and hours of operation;

(3) signal and reception range;

(4) effect of altitude;

(5) communication (R/T procedures and ATC liaison);

(6) obtaining and using types of bearings, for example QTE, QDM, QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix.

(b) Air exercise:

(1) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR SERVICES

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMS;

(4) provision of service;

(5) communication (R/T, procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL PROCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the airship radio;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:

(1) radio equipment serviceability checks;

(2) departure clearance;

(3) navaid selection;

(4) frequencies, radials, etc.;

(5) aerodrome departure checks, frequency changes, altitude and position reports;

(6) SID procedures.

EXERCISE 10: INSTRUMENT APPROACHES: ILS APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACHES PROCEDURES

(a) Long briefing objectives:

(1) precision approach charts;

(2) approach to the initial approach fix and minimum sector altitude;

(3) navaid requirements, for example radar, ADF, etc.;

(4) communication (ATC liaison and R/T phraseology);

(5) review;

(6) holding procedure;

(7) the final approach track;

(8) forming a mental picture of the approach;

(9) completion of aerodrome approach checks;

(10) initial approach procedure;

(11) selection of the ILS frequency and identification;

(12) obstacle clearance altitude or height;

(13) operating minima;

(14) achieving the horizontal and vertical patterns;

(15) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(16) use of DME (as applicable);

(17) go-around and missed approach procedure;

(18) review of the published instructions;

(19) transition from instrument to visual flight (sensory illusions);

(20) visual manoeuvring after an instrument approach;

(i) circling approach;

(ii) visual approach to landing.

(b) Air exercise:

(1) initial approach to the ILS;

(2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of runway lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface (and the length of the landing runway);

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localiser and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height;

(viii) runway direction.

(17) missed approach procedure;

(18) transition from instrument to visual flight;

(19) circling approach;

(20) visual approach to landing.

EXERCISE 11: INSTRUMENT APPROACHES: NDB APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACHES PROCEDURE

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning:

(i) holding procedure;

(ii) the approach track;

(iii) forming a mental picture of the approach;

(iv) initial approach procedure;

(v) operating minima;

(vi) completion of approach planning.

(6) achieving the horizontal and vertical patterns;

(7) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(8) use of DME (as applicable);

(9) go-around and missed approach procedure;

(10) review of the published instructions;

(11) transition from instrument to visual flight (sensory illusions);

(12) visual manoeuvring after an instrument approach;

(13) circling approach;

(14) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning including;

(2) determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach.

(3) circling approach;

(4) go-around and missed approach procedure;

(5) initial approach;

(6) frequency selection and identification;

(7) review of the published procedure and minimum safe sector altitude;

(8) ATC liaison and R/T phraseology;

(9) determination of decision height and altimeter setting;

(10) weather considerations, for example cloud base and visibility;

(11) availability of runway lighting;

(12) determination of inbound track;

(13) assessment of time from final approach fix to the missed approach point;

(14) ATC liaison;

(15) the outbound procedure (inclusive completion of pre-landing checks);

(16) the inbound procedure;

(17) re-check of identification code;

(18) altimeter setting re-checked;

(19) the final approach;

(20) note time and descent rate;

(21) maintaining the final approach track;

(22) anticipation of change in wind velocity and its effect on the drift;

(23) minimum descent altitude or height;

(24) runway direction;

(25) go-around and missed approach procedure;

(26) transition from instrument to visual flight (sensory illusions);

(27) visual approach.

EXERCISE 12: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF GNNS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

FCL.940.IRI IRI — Revalidation and renewal

For revalidation and renewal of an IRI certificate, the holder shall meet the requirements for revalidation and renewal of an FI certificate, in accordance with FCL.940.FI.

SECTION 7 - Specific requirements for the synthetic flight instructor — SFI

FCL.905.SFI SFI — Privileges and conditions

The privileges of an SFI are to carry out synthetic flight instruction, within the relevant aircraft category, for:

(a) the issue, revalidation and renewal of an IR, provided that he/she holds or has held an IR in the relevant aircraft category and has completed an IRI training course; and

(b) in the case of SFI for single-pilot aeroplanes:

(1) the issue, revalidation and renewal of type ratings for single-pilot high performance complex aeroplanes, when the applicant seeks privileges to operate in single-pilot operations.

The privileges of the SFI(SPA) may be extended to flight instruction for single-pilot high performance complex aeroplanes type ratings in multi- pilot operations, provided that he/she:

(i) holds an MCCI certificate; or

(ii) holds or has held a TRI certificate for multi-pilot aeroplanes; and

(2) provided that the privileges of the SFI(SPA) have been extended to multi-pilot operations in accordance with (1):

(i) MCC;

(ii) the MPL course on the basic phase;

(c) in the case of SFI for multi-pilot aeroplanes:

(1) the issue, revalidation and renewal of type ratings for:

(i) multi-pilot aeroplanes;

(ii) single-pilot high performance complex aeroplanes when the applicant seeks privileges to operate in multi-pilot operations;

(2) MCC;

(3) the MPL course on the basic, intermediate and advanced phases, provided that, for the basic phase, he/she holds or has held an FI(A) or an IRI(A) certificate;

(d) in the case of SFI for helicopters:

(1) the issue, revalidation and renewal of helicopter type ratings;

(2) MCC training, when the SFI has privileges to instruct for multi-pilot helicopters.

FCL.910.SFI SFI — Restricted privileges

The privileges of the SFI shall be restricted to the FTD 2/3 or FFS of the aircraft type in which the SFI training course was taken.

The privileges may be extended to other FSTDs representing further types of the same category of aircraft when the holder has:

(a) satisfactorily completed the simulator content of the relevant type rating course; and

(b) conducted on a complete type rating course at least 3 hours of flight instruction related to the duties of an SFI on the applicable type under the supervision and to the satisfaction of a TRE qualified for this purpose.

FCL.915.SFI SFI — Prerequisites

An applicant for an SFI certificate shall:

(a) hold or have held a CPL, MPL or ATPL in the appropriate aircraft category;

(b) have completed the proficiency check for the issue of the specific aircraft type rating in an FFS representing the applicable type, within the 12 months preceding the application; and

(c) additionally, for an SFI(A) for multi-pilot aeroplanes or SFI(PL), have:

(1) at least 1 500 hours flight time as a pilot on multi-pilot aeroplanes or powered-lift, as applicable;

(2) completed, as a pilot or as an observer, within the 12 months preceding the application, at least:

(i) 3 route sectors on the flight deck of the applicable aircraft type; or

(ii) 2 line-orientated flight training-based simulator sessions conducted by qualified flight crew on the flight deck of the applicable type. These simulator sessions shall include 2 flights of at least 2 hours each between 2 different aerodromes, and the associated pre-flight planning and de-briefing;

(d) additionally, for an SFI(A) for single-pilot high performance complex aeroplanes:

(1) have completed at least 500 hours of flight time as PIC on single-pilot aeroplanes;

(2) hold or have held a multi-engine IR(A) rating; and

(3) have met the requirements in (c)(2);

(e) additionally, for an SFI(H), have:

(1) completed, as a pilot or as an observer, at least 1 hour of flight time on the flight deck of the applicable type, within the 12 months preceding the application; and

(2) in the case of multi-pilot helicopters, at least 1 000 hours of flying experience as a pilot on helicopters, including at least 350 hours as a pilot on multi-pilot helicopters;

(3) in the case of single-pilot multi-engine helicopters, completed 500 hours as pilot of helicopters, including 100 hours as PIC on single-pilot multi- engine helicopters;

(4) in the case of single-pilot single-engine helicopters, completed 250 hours as a pilot on helicopters.

FCL.930.SFI SFI — Training course

(a) The training course for the SFI shall include:

(1) the FSTD content of the applicable type rating course;

(2) the content of the TRI training course.

(b) An applicant for an SFI certificate who holds a TRI certificate for the relevant type shall be fully credited towards the requirements of this paragraph.

FCL.940.SFI SFI — Revalidation and renewal

(a) Revalidation. For revalidation of an SFI certificate the applicant shall, within the validity period of the SFI certificate, fulfil 2 of the following 3 requirements:

(1) complete 50 hours as an instructor or an examiner in FSTDs, of which at least 15 hours shall be within the 12 months preceding the expiry date of the SFI certificate;

(2) receive instructor refresher training as an SFI at an ATO;

(3) pass the relevant sections of the assessment of competence in accordance with FCL.935.

(b) Additionally, the applicant shall have completed, on an FFS, the proficiency checks for the issue of the specific aircraft type ratings representing the types for which privileges are held.

(c) For at least each alternate revalidation of an SFI certificate, the holder shall have to comply with the requirement of (a)(3).

(d) Renewal. If the SFI certificate has lapsed, the applicant shall, within the 12 months preceding the application:

(1) complete the simulator content of the SFI training course;

(2) fulfil the requirements specified in (a)(2) and (3).

SECTION 8 - Specific requirements for the multi-crew cooperation instructor — MCCI

FCL.905.MCCI MCCI — Privileges and conditions

(a) The privileges of an MCCI are to carry out flight instruction during:

(1) the practical part of MCC courses when not combined with type rating training; and

(2) in the case of MCCI(A), the basic phase of the MPL integrated training course, provided he/she holds or has held an FI(A) or an IRI(A) certificate.

FCL.910.MCCI MCCI — Restricted privileges

The privileges of the holder of an MCCI certificate shall be restricted to the FNPT II/III MCC, FTD 2/3 or FFS in which the MCCI training course was taken.

The privileges may be extended to other FSTDs representing further types of aircraft when the holder has completed the practical training of the MCCI course on that type of FNPT II/III MCC, FTD 2/3 or FFS.

FCL.915.MCCI MCCI — Prerequisites

An applicant for an MCCI certificate shall:

(a) hold or have held a CPL, MPL or ATPL in the appropriate aircraft category;

(b) have at least:

(1) in the case of aeroplanes, airships and powered-lift aircraft, 1 500 hours of flying experience as a pilot in multi-pilot operations;

(2) in the case of helicopters, 1 000 hours of flying experience as a pilot in multi-crew operations, of which at least 350 hours in multi-pilot helicopters.

FCL.930.MCCI MCCI — Training course

(a) The training course for the MCCI shall include, at least:

(1) 25 hours of teaching and learning instruction;

(2) technical training related to the type of FSTD where the applicant wishes to instruct;

(3) 3 hours of practical instruction, which may be flight instruction or MCC instruction on the relevant FNPT II/III MCC, FTD 2/3 or FFS, under the supervision of a TRI, SFI or MCCI nominated by the ATO for that purpose. These hours of flight instruction under supervision shall include the assessment of the applicant's competence as described in FCL.920.

(b) Applicants holding or having held an FI, TRI, CRI, IRI or SFI certificate shall be fully credited towards the requirement of (a)(1).

AMC1 FCL.930.MCCI MCCI — Training course

AEROPLANES

GENERAL

(a) The objective of the technical training is to apply the core instructor competencies acquired during the teaching and learning training to MCC training.

(b) During the practical training the applicant should demonstrate the ability to instruct a pilot in MCC.

(c) To supervise applicants for MCCI certificates, the adequate experience should include at least three type rating or MCC courses.

(d) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(e) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

COURSE OBJECTIVE

(f) The course should be designed to give adequate training to the applicant in theoretical knowledge instruction and FSTD instruction to instruct those aspects of MCC required by an applicant for a type rating on a first MP aeroplane.

(g) Confirmation of competency of the applicant to be authorised as an MCCI(A) will be determined by the applicant conducting at least 3 hours MCC instruction to a satisfactory standard on the relevant FNPT or FFS under the supervision of a TRI(A), SFI(A) or MCCI(A) nominated by the ATO for this purpose.

(h) The course consists of three parts:

(1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1
The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The FSTD training consists of the application of core instructor competencies to MCC training in a commercial air transport environment, including principles of threat and error management and CRM.

The content of the training programme should cover MCC course exercises in sufficient depth to meet the standard required for issue of the MCCI(A) certificate.

(b) The course should be related to the type of FSTD on which the applicant wishes to instruct. A training programme should give details of all theoretical knowledge instruction.

(c) Identification and application of human factors (as set in the ATPL syllabus 040) related to MCC aspects of the training.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The content of the instruction programme should cover training exercises as applicable to the MCC requirements of an applicant for a MP type rating.

(b) Training exercises:

The exercises should be accomplished as far as possible in a simulated commercial air transport environment. The instruction should cover the following areas:

(1) pre-flight preparation, including documentation, and computation of take-off performance data;

(2) pre-flight checks, including radio and navigation equipment checks and setting;

(3) before take-off checks, including powerplant checks, and take-off briefing by the PF;

(4) normal take-offs with different flap settings, tasks of PF and PNF, call-outs;

(5) rejected take-offs; crosswind take-offs; take-offs at maximum take-off mass; engine failure after v_1;

(6) normal and abnormal operation of aircraft systems, use of checklists;

(7) selected emergency procedures to include engine failure and fire, smoke control and removal, windshear during take-off and landing, emergency descent, incapacitation of a flight crew member;

(8) early recognition of and reaction on approaching stall in differing aircraft configurations;

(9) instrument flight procedures, including holding procedures; precision approaches using raw navigation data, flight director and automatic pilot, one engine simulated inoperative approaches, non-precision and circling approaches, approach briefing by the PF, setting of navigation equipment, call-out procedures during approaches; computation of approach and landing data;

(10) go-arounds; normal and with one engine simulated inoperative, transition from instrument to visual flight on reaching decision height or minimum descent height or altitude;

(11) landings, normal, crosswind and with one engine simulated inoperative, transition from instrument to visual flight on reaching decision height or minimum descent height or altitude.

FCL.940.MCCI MCCI — Revalidation and renewal

(a) For revalidation of an MCCI certificate the applicant shall have completed the requirements of FCL.930.MCCI(a)(3) on the relevant type of FNPT II/III, FTD 2/3 or FFS, within the last 12 months of the validity period of the MCCI certificate.

(b) Renewal. If the MCCI certificate has lapsed, the applicant shall complete the requirements of FCL.930.MCCI(a)(2) and (3) on the relevant type of FNPT II/III MCC, FTD 2/3 or FFS.

SECTION 9 - Specific requirements for the synthetic training instructor — STI

FCL.905.STI STI — Privileges and conditions

(a) The privileges of an STI are to carry out synthetic flight instruction in the appropriate aircraft category for:

(1) the issue of a licence;

(2) the issue, revalidation or renewal of an IR and a class or type rating for single-pilot aircraft, except for single-pilot high performance complex aeroplanes.

(b) Additional privileges for the STI(A). The privileges of an STI(A) shall include synthetic flight instruction during the core flying skills training of the MPL integrated training course.

FCL.910.STI STI — Restricted privileges

The privileges of an STI shall be restricted to the FNPT II/III, FTD 2/3 or FFS in which the STI training course was taken.

The privileges may be extended to other FSTDs representing further types of aircraft when the holder has:

(a) completed the FFS content of the TRI course on the applicable type;

(b) passed the proficiency check for the specific aircraft type rating on an FFS of the applicable type, within the 12 months preceding the application;

(c) conducted, on a type rating course, at least one FSTD session related to the duties of an STI with a minimum duration of 3 hours on the applicable type of aircraft, under the supervision of a flight instructor examiner (FIE).

FCL.915.STI STI — Prerequisites

An applicant for an STI certificate shall:

(a) hold, or have held within the 3 years prior to the application, a pilot licence and instructional privileges appropriate to the courses on which instruction is intended;

(b) have completed in an FNPT the relevant proficiency check for the class or type rating, within a period of 12 months preceding the application.

An applicant for an STI(A) wishing to instruct on BITDs only, shall complete only the exercises appropriate for a skill test for the issue of a PPL(A);

(c) additionally, for an STI(H), have completed at least 1 hour of flight time as an observer on the flight deck of the applicable type of helicopter, within the 12 months preceding the application.

FCL.930.STI STI — Training course

(a) The training course for the STI shall comprise at least 3 hours of flight instruction related to the duties of an STI in an FFS, FTD 2/3 or FNPT II/III, under the supervision of an FIE. These hours of flight instruction under supervision shall include the assessment of the applicant's competence as described in FCL.920.

Applicants for an STI(A) wishing to instruct on a BITD only, shall complete the flight instruction on a BITD.

(b) For applicants for an STI(H), the course shall also include the FFS content of the applicable TRI course.

FCL.940.STI Revalidation and renewal of the STI certificate

(a) Revalidation. For revalidation of an STI certificate the applicant shall have, within the last 12 months of the validity period of the STI certificate:

(1) conducted at least 3 hours of flight instruction in an FFS or FNPT II/III or BITD, as part of a complete CPL, IR, PPL or class or type rating course; and

(2) passed in the FFS, FTD 2/3 or FNPT II/III on which flight instruction is routinely conducted, the applicable sections of the proficiency check in accordance with Appendix 9 to this Part for the appropriate class or type of aircraft.

For an STI(A) instructing on BITDs only, the proficiency check shall include only the exercises appropriate for a skill test for the issue of a PPL(A).

(b) Renewal. If the STI certificate has lapsed, the applicant shall:

(1) receive refresher training as an STI at an ATO;

(2) pass in the FFS, FTD 2/3 or FNPT II/III on which flight instruction is routinely conducted, the applicable sections of the proficiency check in accordance with Appendix 9 to this Part for the appropriate class or type of aircraft.

For an STI(A) instructing on BITDs only, the proficiency check shall include only the exercises appropriate for a skill test for the issue of a PPL(A);

(3) conduct on a complete CPL, IR, PPL or class or type rating course, at least 3 hours of flight instruction under the supervision of an FI, CRI(A), IRI or TRI(H) nominated by the ATO for this purpose. At least 1 hour of flight instruction shall be supervised by an FIE(A).

SECTION 10 - Mountain rating instructor — MI

FCL.905.MI MI — Privileges and conditions

The privileges of an MI are to carry out flight instruction for the issue of a mountain rating.

FCL.915.MI MI — Prerequisites

An applicant for an MI certificate shall:

(a) hold a, FI, CRI, or TRI certificate, with privileges for single-pilot aeroplanes;

(b) hold a mountain rating.

FCL.930.MI MI — Training course

(a) The training course for the MI shall include the assessment of the applicant's competence as described in FCL.920.

(b) Before attending the course, applicants shall have passed a pre-entry flight test with an MI holding an FI certificate to assess their experience and ability to undertake the training course.

FCL.940.MI Validity of the MI certificate

The MI certificate is valid as long as the FI, TRI or CRI certificate is valid.

SECTION 11 - Specific requirements for the flight test instructor — FTI

FCL.905.FTI FTI — Privileges and conditions

(a) The privileges of a flight test instructor (FTI) are to instruct, within the appropriate aircraft category, for:

(1) the issue of category 1 or 2 flight test ratings, provided he/she holds the relevant category of flight test rating;

(2) the issue of an FTI certificate, within the relevant category of flight test rating, provided that the instructor has at least 2 years of experience instructing for the issue of flight test ratings.

(b) The privileges of an FTI holding a category 1 flight test rating include the provision of flight instruction also in relation to category 2 flight test ratings.

FCL.915.FTI FTI — Prerequisites

An applicant for an FTI certificate shall:

(a) hold a flight test rating issued in accordance with FCL.820;

(b) have completed at least 200 hours of category 1 or 2 flight tests.

FCL.930.FTI FTI — Training course

(a) The training course for the FTI shall include, at least:

(1) 25 hours of teaching and learning;

(2) 10 hours of technical training, including revision of technical knowledge, the preparation of lesson plans and the development of classroom/ simulator instructional skills;

(3) 5 hours of practical flight instruction under the supervision of an FTI qualified in accordance with FCL.905.FTI(b). These hours of flight instruction shall include the assessment of the applicant’s competence as described in FCL.920.

(b) Crediting:

(1) Applicants holding or having held an instructor certificate shall be fully credited towards the requirement of (a)(1).

(2) In addition, applicants holding or having held an FI or TRI certificate in the relevant aircraft category shall be fully credited towards the requirements of (a)(2).

FCL.940.FTI FTI — Revalidation and renewal

(a) Revalidation. For revalidation of an FTI certificate, the applicant shall, within the validity period of the FTI certificate, fulfil one of the following requirements:

(1) complete at least:

(i) 50 hours of flight tests, of which at least 15 hours shall be within the 12 months preceding the expiry date of the FTI certificate; and

(ii) 5 hours of flight test flight instruction within the 12 months preceding the expiry date of the FTI certificate; or

(2) receive refresher training as an FTI at an ATO. The refresher training shall be based on the practical flight instruction element of the FTI training course, in accordance with FCL.930.FTI(a)(3), and include at least 1 instruction flight under the supervision of an FTI qualified in accordance with FCL.905.FTI(b).

(b) Renewal. If the FTI certificate has lapsed, the applicant shall receive refresher training as an FTI at an ATO. The refresher training shall comply at least with the requirements of FCL.930.FTI(a)(3).

SUBPART K - EXAMINERS

SECTION 1 - Common requirements

FCL.1000 Examiner certificates

(a) General. Holders of an examiner certificate shall:

(1) hold an equivalent licence, rating or certificate to the ones for which they are authorised to conduct skill tests, proficiency checks or assessments of competence and the privilege to instruct for them;

(2) be qualified to act as PIC on the aircraft during a skill test, proficiency check or assessment of competence when conducted on the aircraft.

(b) Special conditions:

(1) In the case of introduction of new aircraft in the Member States or in an operator's fleet, when compliance with the requirements in this Subpart is not possible, the competent authority may issue a specific certificate giving privileges for the conduct of skill tests and proficiency checks. Such a certificate shall be limited to the skill tests and proficiency checks necessary for the introduction of the new type of aircraft and its validity shall not, in any case, exceed 1 year.

(2) Holders of a certificate issued in accordance with (b)(1) who wish to apply for an examiner certificate shall comply with the prerequisites and revalidation requirements for that category of examiner.

(c) Examination outside the territory of the Member States:

(1) Notwithstanding paragraph (a), in the case of skill tests and proficiency checks provided in an ATO located outside the territory of the Member States, the competent authority of the Member State may issue an examiner certificate to an applicant holding a pilot licence issued by a third country in accordance with ICAO Annex 1, provided that the applicant:

(i) holds at least an equivalent licence, rating, or certificate to the one for which they are authorised to conduct skill tests, proficiency checks or assessments of competence, and in any case at least a CPL;

(ii) complies with the requirements established in this Subpart for the issue of the relevant examiner certificate; and

(iii) demonstrates to the competent authority an adequate level of knowledge of European aviation safety rules to be able to exercise examiner privileges in accordance with this Part.

(2) The certificate referred to in paragraph (1) shall be limited to providing skill tests and proficiency tests/checks:

(i) outside the territory of the Member States; and

(ii) to pilots who have sufficient knowledge of the language in which the test/check is given.

GM1 FCL.1000 Examiner certificates

SPECIAL CONDITIONS

When new aircraft are introduced, requirements such as to hold a licence and rating equivalent to the one for which the skill test is being conducted, or to have adequate flight experience, may not be possible to comply with. In this case, to allow for the first ratings for these aircraft to be issued to applicants, competent authorities need the possibility to issue a specific certificate that does not have to comply with the requirements established in this Subpart.

The competent authority should only give these certificates to holders of other examiner certificates. As far as possible, preference should be given to persons with experience in similar types or classes of aircraft, for example, in aircraft having the same kind and number of engines or rotors and of the same order of mass or technology.

The certificate should ideally be limited in validity to the time needed to qualify the first examiners for the new aircraft in accordance with this Subpart, but in any case it should not exceed the 3 years established in the rule.

FCL.1005 Limitation of privileges in case of vested interests

Examiners shall not conduct:

(a) skill tests or assessments of competence of applicants for the issue of a licence, rating or certificate:

(1) to whom they have provided more than 25 % of the required flight instruction for the licence, rating or certificate for which the skill test or assessment of competence is being taken; or

(2) when they have been responsible for the recommendation for the skill test, in accordance with FCL.030(b);

(b) skill tests, proficiency checks or assessments of competence whenever they feel that their objectivity may be affected.

GM1 FCL.1005(b) Limitation of privileges in case of vested interests

Examples of a situation where the examiner should consider if his/her objectivity is affected are when the applicant is a relative or a friend of the examiner, or when they are linked by economical interests or political affiliations, etc.

FCL.1010 Prerequisites for examiners

Applicants for an examiner certificate shall demonstrate:

(a) relevant knowledge, background and appropriate experience related to the privileges of an examiner;

(b) that they have not been subject to any sanctions, including the suspension, limitation or revocation of any of their licences, ratings or certificates issued in accordance with this Part, for non-compliance with the Basic Regulation and its Implementing Rules during the last 3 years.

AMC1 FCL.1010 Prerequisites for examiners

When evaluating the applicant's background, the competent authority should evaluate the personality and character of the applicant, and his/her cooperation with the competent authority.

The competent authority may also take into account whether the applicant has been convicted of any relevant criminal or other offenses, taking into account national law and principles of non-discrimination.

FCL.1015 Examiner standardisation

(a) Applicants for an examiner certificate shall undertake a standardisation course provided by the competent authority or by an ATO and approved by the competent authority.

(b) The standardisation course shall consist of theoretical and practical instruction and shall include, at least:

(1) the conduct of 2 skill tests, proficiency checks or assessments of competences for the licences, ratings or certificates for which the applicant seeks the privilege to conduct tests and checks;

(2) instruction on the applicable requirements in this part and the applicable air operations requirements, the conduct of skill tests, proficiency checks and assessments of competence, and their documentation and reporting;

(3) a briefing on the national administrative procedures, requirements for protection of personal data, liability, accident insurance and fees;

(4) a briefing on the need to review and apply the items in (3) when conducting skill tests, proficiency checks or assessments of competence of an applicant for which the competent authority is not the same that issued the examiner's certificate; and

(5) an instruction on how to get access to these national procedures and requirements of other competent authorities when needed;

(c) Holders of an examiners certificate shall not conduct skill tests, proficiency checks or assessments of competence of an applicant for which the competent authority is not the same that issued the examiner's certificate, unless they have reviewed the latest available information containing the relevant national procedures of the applicant's competent authority.

AMC1 FCL.1015 Examiner standardisation

GENERAL

(a) The competent authority may provide the course itself or through an arrangement with an ATO. This arrangement should clearly state that the ATO is acting under the management system of the competent authority.

(b) The course should last:

(1) for the FE and FIE, at least 1 day, divided into theoretical and practical training;

(2) for other examiners, at least 3 days, divided into theoretical training (1 day) and practical training in an FFS conducting role played proficiency checks and skill tests (at least 2 days).

(c) The competent authority or the ATO should determine any further training required before presenting the candidate for the examiner assessment of competence.

CONTENT

(d) The training should comprise:

(1) Theoretical training covering at least:

(i) the contents of AMC2 FCL.1015 and the FEM;

(ii) Part-FCL and related AMCs and GM relevant to their duties;

(iii) operational requirements and related AMCs and GM relevant to their duties;

(iv) national requirements relevant to their examination duties;

(v) fundamentals of human performance and limitations relevant to flight examination;

(vi) fundamentals of evaluation relevant to applicant's performance;

(vii) management system of ATOs;

(viii) MCC, human performance and limitations, if applicable.

(2) Examiners should also be briefed on the protection requirements for personal data, liability, accident insurance and fees, as applicable in the member state concerned.

(3) All items above are the core knowledge requirements for an examiner and are recommended as the core course material. This core course may be studied before recommended examiner training is commenced. The core course may utilise any suitable training format.

(4) Practical training consisting of at least:

(i) knowledge and management of the test for which the certificate is to be sought. These are described in the relevant modules in the FEM;

(ii) knowledge of the administrative procedures pertaining to that test or check.

(5) For an initial examiner certificate, practical training should include the examination of the test profile sought, consisting of the conduct of at least two test or check profiles in the role of examiner (these two tests or checks profiles can be performed in the same simulator session), including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. This training is conducted in the aircraft if approval for testing or checking in the aircraft is required. If examiner privileges in FSTD's are required, practical instruction in the use of FSTD(s) for testing or checking should also be completed.

(6) If examiner privileges are to include the conduct of proficiency checks for the revalidation or renewal of an instrument rating, practical instruction should include the conduct of at least four instrument check profiles in the role of examiner, including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. This training is conducted in the aircraft if approval for testing or checking in the aircraft is required. If examiner

privileges in both FSTD and aircraft are required, at least one of the instrument check profiles should be conducted in an FSTD.

(7) For extension of an examiner certificate to further types (as required for TRE), further practical training on the new type may be required, consisting of the conduct of at least one test or check profile in the role of examiner on the new type, including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. A further examiner check on the new type may be required, which may be supervised by an inspector of the competent authority or a suitably authorised senior examiner.

AMC2 FCL.1015 Examiner standardisation

STANDARDISATION ARRANGEMENTS FOR EXAMINERS

LIMITATIONS

(a) An examiner should allow an applicant adequate time to prepare for a test or check, normally not more than 1 hour.

(b) An examiner should plan a test or check flight so that all required exercises can be performed while allowing sufficient time for each of the exercises and with due regard to the weather conditions, traffic situation, ATC requirements and local procedures.

PURPOSE OF A TEST OR CHECK

(c) Determine through practical demonstration during a test or check that an applicant has acquired or maintained the required level of knowledge and skill or proficiency.

(d) Improve training and flight instruction in ATOs by feedback of information from examiners about items or sections of tests or checks that are most frequently failed.

(e) Assist in maintaining and, where possible, improving air safety standards by having examiners display good airmanship and flight discipline during tests or checks.

CONDUCT OF TEST OR CHECK

(f) An examiner will ensure that an applicant completes a test or check in accordance with Part-FCL requirements and is assessed against the required test or check standards.

(g) Each item within a test or check section should be completed and assessed separately. The test or check schedule, as briefed, should not normally be altered by an examiner. A failed item is not always a failed section, for example type rating skill test where a failure of an item in a section does not fail the entire section, only the failed item is taken again.

(h) Marginal or questionable performance of a test or check item should not influence an examiner's assessment of any subsequent items.

(i) An examiner should verify the requirements and limitations of a test or check with an applicant during the pre-flight briefing.

(j) When a test or check is completed or discontinued, an examiner should debrief the applicant and give reasons for items or sections failed. In case of a failed or discontinued skill test and proficiency check, the examiner should provide appropriate advice to assist the applicant in re-tests or re-checks.

(k) Any comment on, or disagreement with, an examiner's test or check evaluation or assessment made during a debriefing will be recorded by the examiner on the test or check report, and will be signed by the examiner and countersigned by the applicant.

EXAMINER PREPARATION

(l) An examiner should supervise all aspects of the test or check flight preparation, including, where necessary, obtaining or assuring an ATC 'slot' time.

(m) An examiner will plan a test or check in accordance with Part-FCL requirements. Only the manoeuvres and procedures set out in the appropriate test or check form will be undertaken. The same examiner should not re-examine a failed applicant without the agreement of the applicant.

EXAMINER APPROACH

(n) An examiner should encourage a friendly and relaxed atmosphere to develop both before and during a test or check flight. A negative or hostile approach should not be used. During the test or check flight, the examiner should avoid negative comments or criticisms and all assessments should be reserved for the debriefing.

ASSESSMENT SYSTEM

(o) Although test or checks may specify flight test tolerances, an applicant should not be expected to achieve these at the expense of smoothness or stable flight. An examiner should make due allowance for unavoidable deviations due to turbulence, ATC instructions, etc. An examiner should terminate a test or check only when it is clear that the applicant has not been able to demonstrate the required level of knowledge, skill or proficiency and that a full re-test will be necessary or for safety reasons. An examiner will use one of the following terms for assessment:

(1) a 'pass', provided that the applicant demonstrates the required level of knowledge, skill or proficiency and, where applicable, remains within the flight test tolerances for the licence or rating;

(2) a 'fail' provided that any of the following apply:

(i) the flight test tolerances have been exceeded after the examiner has made due allowance for turbulence or ATC instructions;

(ii) the aim of the test or check is not completed;

(iii) the aim of exercise is completed but at the expense of safe flight, violation of a rule or regulation, poor airmanship or rough handling;

(iv) an acceptable level of knowledge is not demonstrated;

(v) an acceptable level of flight management is not demonstrated;

(vi) the intervention of the examiner or safety pilot is required in the interest of safety.

(3) a 'partial pass' in accordance with the criteria shown in the relevant skill test appendix of Part-FCL.

METHOD AND CONTENTS OF THE TEST OR CHECK

(p) Before undertaking a test or check an examiner will verify that the aircraft or FSTD intended to be used is suitable and appropriately equipped for the test or check.

(q) A test or check flight will be conducted in accordance with the AFM and, if applicable, the AOM.

(r) A test or check flight will be conducted within the limitations contained in the operations manual of an ATO.

(s) Contents:

(1) a test or check is comprised of:

(i) oral examination on the ground (where applicable);

(ii) pre-flight briefing;

(iii) in-flight exercises;

(iv) post-flight debriefing.

(2) oral examination on the ground should include:

(i) aircraft general knowledge and performance;

(ii) planning and operational procedures;

(iii) other relevant items or sections of the test or check.

(3) pre-flight briefing should include:

(i) test or check sequence;

(ii) power setting, speeds and approach minima, if applicable;

(iii) safety considerations.

(4) in-flight exercises will include each relevant item or section of the test or check;

(5) post-flight debriefing should include:

(i) assessment or evaluation of the applicant;

(ii) documentation of the test or check with the applicant's FI present, if possible.

(t) A test or check is intended to simulate a practical flight. Thus, an examiner may set practical scenarios for an applicant while ensuring that the applicant is not confused and air safety is not compromised.

(u) When manoeuvres are to be flown by sole reference to instruments, the examiner should ensure that a suitable method of screening is used to simulate IMC.

(v) An examiner should maintain a flight log and assessment record during the test or check for reference during the post or flight debriefing.

(w) An examiner should be flexible to the possibility of changes arising to pre-flight briefings due to ATC instructions, or other circumstances affecting the test or check.

(x) Where changes arise to a planned test or check an examiner should be satisfied that the applicant understands and accepts the changes. Otherwise, the test or check flight should be terminated.

(y) Should an applicant choose not to continue a test or check for reasons considered inadequate by an examiner, the applicant will be assessed as having failed those items or sections not attempted. If the test or check is terminated for reasons considered adequate by the examiner, only these items or sections not completed will be tested during a subsequent test or check.

(z) An examiner may terminate a test or check at any stage, if it is considered that the applicant's competency requires a complete re-test or re-check.

GM1 FCL.1015 Examiner standardisation

(a) An examiner should plan per day not more than:

(1) three tests or checks relating to PPL, CPL, IR or class ratings;

(2) four tests or checks relating to LAPL, SPL or BPL;

(3) two tests or checks related to CPL, IR or ATPL;

(4) two assessments of competence related to instructor certificates;

(5) four tests or checks relating to SP type ratings.

(b) An examiner should plan at least 2 hours for a LAPL, SPL or BPL, 3 hours for a PPL, CPL, IR or class rating test or checks, and at least 4 hours for FI, CPL, IR, MPL, ATPL or MP type rating tests or checks, including pre-flight briefing and preparation, conduct of the test, check or assessment of competence, de-briefing, evaluation of the applicant and document-tation.

(c) When planning the duration of a test, check or assessment of competence, the following values may be used as guidance:

(1) 45 minutes for a LAPL(B) or BPL and SP class ratings VFR only;

(2) 90 minutes for LAPL(A) or (H), PPL and CPL, including navigation section;

(3) 60 minutes for IR, FI and SP type or class ratings;

(4) 120 minutes for CPL, MPL, ATPL and MP type ratings.

(d) For the LAPL(S) and SPL test or check flight the flight time must be sufficient to allow that all the items in each test or check section can be fully completed. If not all the items can be completed in one flight, additional flights have to be done.

FCL.1020 Examiners assessment of competence

Applicants for an examiner certificate shall demonstrate their competence to an inspector from the competent authority or a senior examiner specifically authorised to do so by the competent authority responsible for the examiner's certificate through the conduct of a skill test, proficiency check or assessment of competence in the examiner role for which privileges are sought, including briefing, conduct of the skill test, proficiency check or assessment of competence, and assessment of the person to whom the test, check or assessment is given, debriefing and recording documentation.

AMC1 FCL.1020 Examiners assessment of competence

GENERAL

(a) The competent authority may nominate either one of its inspectors or a senior examiner to assess the competence of applicants for an examiner certificate.

DEFINITIONS

(b) Definitions:

(1) 'Inspector': the inspector of the competent authority conducting the examiner competence assessment;

(2) 'Examiner applicant': the person seeking certification as an examiner;

(3) 'Candidate': the person being tested or checked by the examiner applicant. This person may be a pilot for whom the test or check would be required, or the inspector of the competent authority who is conducting the examiner certification acceptance test.

CONDUCT OF THE ASSESSMENT

(c) An inspector of the competent authority or a senior examiner will observe all examiner applicants conducting a test on a 'candidate' in an aircraft for which examiner certificate is sought. Items from the related training course and test or check schedule will be selected by the inspector for examination of the 'candidate' by the examiner applicant.

Having agreed with the inspector the content of the test, the examiner applicant will be expected to manage the entire test. This will include briefing, the conduct of the flight, assessment and debriefing of the 'candidate'. The inspector will discuss the assessment with the examiner applicant before the 'candidate' is debriefed and informed of the result.

BRIEFING THE 'CANDIDATE'

(d) The 'candidate' should be given time and facilities to prepare for the test flight. The briefing should cover the following:

(1) the objective of the flight;

(2) licensing checks, as necessary;

(3) freedom for the 'candidate' to ask questions;

(4) operating procedures to be followed (for example operators manual);

(5) weather assessment;

(6) operating capacity of 'candidate' and examiner;

(7) aims to be identified by 'candidate';

(8) simulated weather assumptions (for example icing and cloud base);

(9) use of screens (if applicable);

(10) contents of exercise to be performed;

(11) agreed speed and handling parameters (for example V-speeds, bank angle, approach minima);

(12) use of R/T;

(13) respective roles of 'candidate' and examiner (for example during emergency);

(14) administrative procedures (for example submission of flight plan).

(e) The examiner applicant should maintain the necessary level of communication with the 'candidate'. The following check details should be followed by the examiner applicant:

(1) involvement of examiner in a MP operating environment;

(2) the need to give the 'candidate' precise instructions;

(3) responsibility for safe conduct of the flight;

(4) intervention by examiner, when necessary;

(5) use of screens;

(6) liaison with ATC and the need for concise, easily understood intentions;

(7) prompting the 'candidate' about required sequence of events (for example following a go-around);

(8) keeping brief, factual and unobtrusive notes.

ASSESSMENT

(f) The examiner applicant should refer to the flight test tolerances given in the relevant skill test. Attention should be paid to the following points:

(1) questions from the 'candidate';

(2) give results of the test and any sections failed;

(3) give reasons for failure.

DEBRIEFING

(g) The examiner applicant should demonstrate to the inspector the ability to conduct a fair, unbiased debriefing of the 'candidate' based on identifiable factual items. A balance between friendliness and firmness should be evident. The following points should be discussed with the 'candidate', at the applicant's discretion:

(1) advise the candidate on how to avoid or correct mistakes;

(2) mention any other points of criticism noted;

(3) give any advice considered helpful.

RECORDING OR DOCUMENTATION

(h) The examiner applicant should demonstrate to the inspector the ability to complete the relevant records correctly. These records may be:

(1) the relevant test or check form;

(2) licence entry;

(3) notification of failure form;

(4) relevant company forms where the examiner has privileges of conducting operator proficiency checks.

DEMONSTRATION OF THEORETICAL KNOWLEDGE

(i) The examiner applicant should demonstrate to the inspector a satisfactory knowledge of the regulatory requirements associated with the function of an examiner.

AMC1 FCL.1020; FCL.1025

QUALIFICATION OF SENIOR EXAMINERS

(a) A senior examiner specifically tasked by the competent authority to observe skill tests or proficiency checks for the revalidation of examiner certificates should:

(1) hold a valid or current examiner certificate appropriate to the privileges being given;

(2) have examiner experience level acceptable to the competent authority;

(3) have conducted a number of skill tests or proficiency checks as a Part-FCL examiner.

(b) The competent authority may conduct a pre-assessment of the applicant or candidate carrying out a skill test and proficiency check under supervision of an inspector of the competent authority.

(c) Applicants should be required to attend a senior examiner briefing, course or seminar arranged by the competent authority. Content and duration will be determined by the competent authority and should include:

(1) pre-course self-study;

(2) legislation;

(3) the role of the senior examiner;

(4) an examiner assessment;

(5) national administrative requirements.

(d) The validity of the authorisation should not exceed the validity of the examiners certificate, and in any case should not exceed 3 years. The authorisation may be revalidated in accordance with procedures established by the competent authority.

FCL.1025 Validity, revalidation and renewal of examiner certificates

(a) Validity. An examiner certificate shall be valid for 3 years.

(b) Revalidation. An examiner certificate shall be revalidated when the holder has, during the validity period of the certificate:

(1) conducted at least 2 skill tests, proficiency checks or assessments of competence every year;

(2) attended an examiner refresher seminar provided by the competent authority or by an ATO and approved by the competent authority, during the last year of the validity period.

(3) One of the skill tests or proficiency checks completed during the last year of the validity period in accordance with (1) shall have been assessed by an inspector from the competent authority or by a senior examiner specifically authorised to do so by the competent authority responsible for the examiner's certificate.

(4) When the applicant for the revalidation holds privileges for more than one category of examiner, combined revalidation of all examiner privileges may be achieved when the applicant complies with the requirements in (b)(1) and (2) and FCL.1020 for one of the categories of examiner certificate held, in agreement with the competent authority.

(c) Renewal. If the certificate has expired, applicants shall comply with the requirements of (b)(2) and FCL.1020 before they can resume the exercise of the privileges.

(d) An examiner certificate shall only be revalidated or renewed if the applicant demonstrates continued compliance with the requirements in FCL.1010 and FCL.1030.

AMC1 FCL.1020; FCL.1025

AMC1 FCL.1025 Validity, revalidation and renewal of examiner certificates

EXAMINER REFRESHER SEMINAR

The examiner refresher seminar should follow the content of the examiner standardisation course, included in AMC1 FCL.1015, and take into account specific contents adequate to the category of examiner affected.

FCL.1030 Conduct of skill tests, proficiency checks and assessments of competence

(a) When conducting skill tests, proficiency checks and assessments of competence, examiners shall:

(1) ensure that communication with the applicant can be established without language barriers;

(2) verify that the applicant complies with all the qualification, training and experience requirements in this Part for the issue, revalidation or renewal of the licence, rating or certificate for which the skill test, proficiency check or assessment of competence is taken;

(3) make the applicant aware of the consequences of providing incomplete, inaccurate or false information related to their training and flight experience.

(b) After completion of the skill test or proficiency check, the examiner shall:

(1) inform the applicant of the result of the test. In the event of a partial pass or fail, the examiner shall inform the applicant that he/she may not exercise the privileges of the rating until a full pass has been obtained. The examiner shall detail any further training requirement and explain the applicant's right of appeal;

(2) in the event of a pass in a proficiency check or assessment of competence for revalidation or renewal, endorse the applicant's licence or certificate with the new expiry date of the rating or certificate, if specifically authorised for that purpose by the competent authority responsible for the applicant's licence;

(3) provide the applicant with a signed report of the skill test or proficiency check and submit without delay copies of the report to the competent authority responsible for the applicant's licence, and to the competent authority that issued the examiner certificate. The report shall include:

(i) a declaration that the examiner has received information from the applicant regarding his/her experience and instruction, and found that experience and instruction complying with the applicable requirements in this Part;

(ii) confirmation that all the required manoeuvres and exercises have been completed, as well as information on the verbal theoretical knowledge examination, when applicable. If an item has been failed, the examiner shall record the reasons for this assessment;

(iii) the result of the test, check or assessment of competence;

(iv) a declaration that the examiner has reviewed and applied the national procedures and requirements of the applicant's competent authority if the competent authority responsible for the applicant's licence is not the same that issued the examiner's certificate;

(v) a copy of the examiner certificate containing the scope of his/her privileges as examiner in the case of skill tests, proficiency checks or assessments of competence of an applicant for which the competent authority is not the same that issued the examiner's certificate.

(c) Examiners shall maintain records for 5 years with details of all skill tests, proficiency checks and assessments of competence performed and their results.

(d) Upon request by the competent authority responsible for the examiner certificate, or the competent authority responsible for the applicant's licence, examiners shall submit all records and reports, and any other information, as required for oversight activities.

AMC1 FCL.1030 (b)(3) Conduct of skill tests, proficiency checks and assessments of competence

OBLIGATIONS FOR EXAMINERS APPLICATION AND REPORT FORMS

Common application and report forms can be found:

(a) For skill tests or proficiency checks for issue, revalidation or renewal of LAPL, BPL, SPL, PPL, CPL and IR in AMC1 to Appendix 7;

(b) For training, skill tests or proficiency checks for ATPL, MPL or class and type ratings, in AMC1 to Appendix 9;

(c) For assessments of competence for instructors, in AMC5 FCL.935.

SECTION 2 - Specific requirements for flight examiners — FE

FCL.1005.FE FE — Privileges and conditions

(a) FE(A). The privileges of an FE for aeroplanes are to conduct:

(1) skill tests for the issue of the PPL(A) and skill tests and proficiency checks for associated single-pilot class and type ratings, except for single-pilot high performance complex aeroplanes, provided that the examiner has completed at least 1 000 hours of flight time as a pilot on aeroplanes or TMGs, including at least 250 hours of flight instruction;

(2) skill tests for the issue of the CPL(A) and skill tests and proficiency checks for the associated single-pilot class and type ratings, except for single-pilot high performance complex aeroplanes, provided that the examiner has completed at least 2 000 hours of flight time as a pilot on aeroplanes or TMGs, including at least 250 hours of flight instruction;

(3) skill tests and proficiency checks for the LAPL(A), provided that the examiner has completed at least 500 hours of flight time as a pilot on aeroplanes or TMGs, including at least 100 hours of flight instruction;

(4) skill tests for the issue of a mountain rating, provided that the examiner has completed at least 500 hours of flight time as a pilot on aeroplanes or TMGs, including at least 500 take-offs and landings of flight instruction for the mountain rating;

(5) proficiency checks for the revalidation and renewal of EIRs, provided that the FE has completed at least 1 500 hours as a pilot on aeroplanes and complies with the requirements in FCL.1010.IRE(a)(2).

(b) FE(H). The privileges of an FE for helicopters are to conduct:

(1) skill tests for the issue of the PPL(H) and skill tests and proficiency checks for single-pilot single-engine helicopter type ratings entered in a PPL(H), provided that the examiner has completed 1 000 hours of flight time as a pilot on helicopters, including at least 250 hours of flight instruction;

(2) skill tests for the issue of the CPL(H) and skill tests and proficiency checks for single-pilot single-engine helicopter type ratings entered in a CPL(H), provided the examiner has completed 2 000 hours of flight time as pilot on helicopters, including at least 250 hours of flight instruction;

(3) skill tests and proficiency checks for single-pilot multi-engine helicopter type ratings entered in a PPL(H) or a CPL(H), provided the examiner has completed the requirements in (1) or (2), as applicable, and holds a CPL(H) or ATPL(H) and, when applicable, an IR(H);

(4) skill tests and proficiency checks for the LAPL(H), provided that the examiner has completed at least 500 hours of flight time as a pilot on helicopters, including at least 150 hours of flight instruction.

(c) FE(As). The privileges of an FE for airships are to conduct skill tests for the issue of the PPL(As) and CPL(As) and skill tests and proficiency checks for the associated airship type ratings, provided that the examiner has completed 500 hours of flight time as a pilot on airships, including 100 hours of flight instruction.

(d) FE(S). The privileges of an FE for sailplanes are to conduct:

(1) skill tests and proficiency checks for the SPL and the LAPL(S), provided that the examiner has completed 300 hours of flight time as a pilot on sailplanes or powered sailplanes, including 150 hours or 300 launches of flight instruction;

(2) proficiency checks for the extension of the SPL privileges to commercial operations, provided that the examiner has completed 300 hours of flight time as a pilot on sailplanes or powered sailplanes, including 90 hours of flight instruction;

(3) skill tests for the extension of the SPL or LAPL(S) privileges to TMG, provided that the examiner has completed 300 hours of flight time as a pilot on sailplanes or powered sailplanes, including 50 hours of flight instruction on TMG;

(4) skill tests and proficiency checks for the cloud flying rating, provided that the examiner has completed at least 200 hours of flight time as pilot on sailplanes or powered sailplanes, including at least 5 hours or 25 flights of flight instruction for the cloud flying rating or at least 10 hours of flight instruction for the EIR or IR(A).

(e) FE(B). The privileges of an FE for balloons are to conduct:

(1) skill tests for the issue of the BPL and the LAPL(B) and skill tests and proficiency checks for the extension of the privileges to another balloon class or group, provided that the examiner has completed 250 hours of flight time as a pilot on balloons, including 50 hours of flight instruction;

(2) proficiency checks for the extension of the BPL privileges to commercial operations, provided that the examiner has completed 300 hours of flight time as a pilot on balloons, of which 50 hours in the same group of balloons for which the extension is sought. The 300 hours of flight time shall include 50 hours of flight instruction.

FCL.1010.FE FE — Prerequisites

An applicant for an FE certificate shall hold:

an FI certificate in the appropriate aircraft category.

SECTION 3 - Specific requirements for type rating examiners — TRE

FCL.1005.TRE TRE — Privileges and conditions

(a) TRE(A) and TRE(PL). The privileges of a TRE for aeroplanes or powered- lift aircraft are to conduct:

(1) skill tests for the initial issue of type ratings for aeroplanes or powered- lift aircraft, as applicable;

(2) proficiency checks for revalidation or renewal of type ratings, EIRs and IRs;

(3) skill tests for ATPL(A) issue;

(4) skill tests for MPL issue, provided that the examiner has complied with the requirements in FCL.925;

(5) assessments of competence for the issue, revalidation or renewal of a TRI or SFI certificate in the applicable aircraft category, provided that the examiner has completed at least 3 years as a TRE.

(b) TRE(H). The privileges of a TRE(H) are to conduct:

(1) skill tests and proficiency checks for the issue, revalidation or renewal of helicopter type ratings;

(2) proficiency checks for the revalidation or renewal of IRs, or for the extension of the IR(H) from single-engine helicopters to multi-engine helicopters, provided the TRE(H) holds a valid IR(H);

(3) skill tests for ATPL(H) issue;

(4) assessments of competence for the issue, revalidation or renewal of a TRI(H) or SFI(H) certificate, provided that the examiner has completed at least 3 years as a TRE.

FCL.1010.TRE TRE — Prerequisites

(a) TRE(A) and TRE(PL). Applicants for a TRE certificate for aeroplanes and powered-lift aircraft shall:

(1) in the case of multi-pilot aeroplanes or powered-lift aircraft, have completed 1 500 hours of flight time as a pilot of multi-pilot aeroplanes or powered-lift aircraft, as applicable, of which at least 500 hours shall be as PIC;

(2) in the case of single-pilot high performance complex aeroplanes, have completed 500 hours of flight time as a pilot of single-pilot aeroplanes, of which at least 200 hours shall be as PIC;

(3) hold a CPL or ATPL and a TRI certificate for the applicable type;

(4) for the initial issue of an TRE certificate, have completed at least 50 hours of flight instruction as a TRI, FI or SFI in the applicable type or an FSTD representing that type.

(b) TRE(H). Applicants for a TRE (H) certificate for helicopters shall:

(1) hold a TRI(H) certificate or, in the case of single-pilot single-engine helicopters, a valid FI(H) certificate, for the applicable type;

(2) for the initial issue of a TRE certificate, have completed 50 hours of flight instruction as a TRI, FI or SFI in the applicable type or an FSTD representing that type;

(3) in the case of multi-pilot helicopters, hold a CPL(H) or ATPL(H) and have completed 1 500 hours of flight as a pilot on multi-pilot helicopters, of which at least 500 hours shall be as PIC;

(4) in the case of single-pilot multi-engine helicopters:

(i) have completed 1 000 hours of flight as pilot on helicopters, of which at least 500 hours shall be as PIC;

(ii) hold a CPL(H) or ATPL(H) and, when applicable, a valid IR(H);

(5) in the case of single-pilot single-engine helicopters:

(i) have completed 750 hours of flight as a pilot on helicopters, of which at least 500 hours shall be as PIC;

(ii) hold a CPL(H) or ATPL(H).

(6) Before the privileges of a TRE(H) are extended from single-pilot multi- engine to multi-pilot multi-engine privileges on the same type of helicopter, the holder shall have at least 100 hours in multi-pilot operations on this type.

(7) In the case of applicants for the first multi-pilot multi-engine TRE certificate, the 1 500 hours of flight experience on multi-pilot helicopters required in (b)(3) may be considered to have been met if they have completed the 500 hours of flight time as PIC on a multi-pilot helicopter of the same type.

Go back to Subpart K
Go back to the content

SECTION 4 - Specific requirements for Class Rating Examiner — CRE

FCL.1005.CRE CRE — Privileges

The privileges of a CRE are to conduct, for single-pilot aeroplanes, except for single-pilot high performance complex aeroplanes:

(a) skill tests for the issue of class and type ratings;

(b) proficiency checks for:

(1) revalidation or renewal of class and type ratings;

(2) revalidation and renewal of IRs, provided that the CRE complies with the requirements in FCL.1010.IRE(a);

(3) revalidation and renewal of EIRs, provided that the CRE has completed at least 1 500 hours as a pilot on aeroplanes and complies with the requirements in FCL.1010.IRE(a)(2).

(c) skill tests for the extension of LAPL(A) privileges to another class or variant of aeroplane.

FCL.1010.CRE CRE — Prerequisites

Applicants for a CRE certificate shall:

(a) hold a CPL(A), MPL(A) or ATPL(A) with single-pilot privileges or have held it and hold a PPL(A);

(b) hold a CRI certificate for the applicable class or type;

(c) have completed 500 hours of flight time as a pilot on aeroplanes.

SECTION 5 - Specific requirements for Instrument Rating Examiner — IRE

FCL.1005.IRE IRE — Privileges

The privileges of the holder of an IRE certificate are to conduct skill tests for the issue, and proficiency checks for the revalidation or renewal of EIRs or IRs.

FCL.1010.IRE IRE — Prerequisites

(a) IRE(A). Applicants for an IRE certificate for aeroplanes shall hold an IRI(A) and have completed:

(1) 2 000 hours of flight time as a pilot of aeroplanes; and

(2) 450 hours of flight time under IFR, of which 250 hours shall be as an instructor.

(b) IRE(H). Applicants for an IRE certificate for helicopters shall hold an IRI(H) and have completed:

(1) 2 000 hours of flight time as a pilot on helicopters; and

(2) 300 hours of instrument flight time on helicopters, of which 200 hours shall be as an instructor.

(c) IRE(As). Applicants for an IRE certificate for airships shall hold an IRI(As) and have completed:

(1) 500 hours of flight time as a pilot on airships; and

(2) 100 hours of instrument flight time on airships, of which 50 hours shall be as an instructor.

SECTION 6 - Specific requirements for Synthetic Flight Examiner — SFE

FCL.1005.SFE SFE — Privileges and conditions

(a) SFE(A) and SFE(PL). The privileges of an SFE on aeroplanes or powered- lift aircraft are to conduct in an FFS:

(1) skill tests and proficiency checks for the issue, revalidation or renewal of type ratings for multi-pilot aeroplanes or powered-lift aircraft, as applicable;

(2) proficiency checks for revalidation or renewal of IRs, provided that the SFE complies with the requirements in FCL.1010.IRE for the applicable aircraft category;

(3) skill tests for ATPL(A) issue;

(4) skill tests for MPL issue, provided that the examiner has complied with the requirements in FCL.925;

(5) assessments of competence for the issue, revalidation or renewal of an SFI certificate in the relevant aircraft category, provided that the examiner has completed at least 3 years as an SFE.

(b) SFE(H). The privileges of an SFE for helicopters are to conduct in an FFS:

(1) skill tests and proficiency checks for the issue, revalidation and renewal of type ratings; and

(2) proficiency checks for the revalidation and renewal of IRs, provided that the SFE complies with the requirements in FCL.1010.IRE(b);

(3) skill tests for ATPL(H) issue;

(4) skill tests and proficiency checks for the issue, revalidation or renewal of an SFI(H) certificate, provided that the examiner has completed at least 3 years as an SFE.

FCL.1010.SFE SFE — Prerequisites

(a) SFE(A). Applicants for an SFE certificate for aeroplanes shall:

(1) hold or have held an ATPL(A), a class or type rating and an SFI(A) certificate for the applicable type of aeroplane;

(2) have at least 1 500 hours of flight time as a pilot on multi-pilot aeroplanes;

(3) for the initial issue of an SFE certificate, have completed at least 50 hours of synthetic flight instruction as an SFI(A) on the applicable type.

(b) SFE(H). Applicants for an SFE certificate for helicopters shall:

(1) hold or have held an ATPL(H), a type rating and an SFI(H) certificate for the applicable type of helicopter;

(2) have at least 1 000 hours of flight time as a pilot on multi-pilot helicopters;

(3) for the initial issue of an SFE certificate, have completed at least 50 hours of synthetic flight instruction as an SFI(H) on the applicable type.

SECTION 7 - Specific requirements for the flight instructor examiner — FIE

FCL.1005.FIE FIE — Privileges and conditions

(a) FIE(A). The privileges of an FIE on aeroplanes are to conduct assessments of competence for the issue, revalidation or renewal of certificates for FI(A), CRI(A), IRI(A) and TRI(A) on single-pilot aeroplanes, provided that the relevant instructor certificate is held.

(b) FIE(H). The privileges of an FIE on helicopters are to conduct assessments of competence for the issue, revalidation or renewal of certificates for FI(H), IRI(H) and TRI(H) on single-pilot helicopters, provided that the relevant instructor certificate is held.

(c) FIE(As), (S), (B). The privileges of an FIE on sailplanes, powered sailplanes, balloons and airships are to conduct assessments of competence for the issue, revalidation or renewal of instructor certificates on the applicable aircraft category, provided that the relevant instructor certificate is held.

FCL.1010.FIE FIE — Prerequisites

(a) FIE(A). Applicants for an FIE certificate for aeroplanes shall:

in case of applicants wishing to conduct assessments of competence:

(1) hold the relevant instructor certificate, as applicable;

(2) have completed 2 000 hours of flight time as a pilot on aeroplanes or TMGs; and

(3) have at least 100 hours of flight time instructing applicants for an instructor certificate.

(b) FIE(H). Applicants for an FIE certificate for helicopters shall:

(1) hold the relevant instructor certificate, as applicable;

(2) have completed 2 000 hours of flight time as pilot on helicopters;

(3) have at least 100 hours of flight time instructing applicants for an instructor certificate.

(c) FIE(As). Applicants for an FIE certificate for airships shall:

(1) have completed 500 hours of flight time as a pilot on airships;

(2) have at least 20 hours of flight time instructing applicants for an FI(AS) certificate;

(3) hold the relevant instructor certificate.

(d) FIE(S). Applicants for an FIE certificate for sailplanes shall:

(1) hold the relevant instructor certificate;

(2) have completed 500 hours of flight time as a pilot on sailplanes or powered sailplanes;

(3) have completed:

(i) for applicants wishing to conduct assessments of competence on TMGs, 10 hours or 30 take-offs instructing applicants for an instructor certificate in TMGs;

(ii) in all other cases, 10 hours or 30 launches instructing applicants for an instructor certificate.

(e) FIE(B). Applicants for an FIE certificate for balloons shall:

(1) hold the relevant instructor certificate;

(2) have completed 350 hours of flight time as a pilot on balloons;

(3) have completed 10 hours instructing applicants for an instructor certificate

Appendices

Appendix 1 - Crediting of theoretical knowledge

A. CREDITING OF THEORETICAL KNOWLEDGE FOR THE ISSUE OF A PILOT LICENCE — BRIDGE INSTRUCTION AND EXAMINATION REQUIREMENTS

1. LAPL, PPL, BPL and SPL

1.1. For the issue of an LAPL, the holder of an LAPL in another category of aircraft shall be fully credited with theoretical knowledge on the common subjects established in FCL.120(a).

1.2. Without prejudice to the paragraph above, for the issue of an LAPL, PPL, BPL or SPL, the holder of a licence in another category of aircraft shall receive theoretical knowledge instruction and pass theoretical knowledge examinations to the appropriate level in the following subjects:

- Principles of Flight,

- Operational Procedures,

- Flight Performance and Planning,

- Aircraft General Knowledge,

- Navigation.

1.3. For the issue of a PPL, BPL or SPL, the holder of an LAPL in the same category of aircraft shall be credited in full towards the theoretical knowledge instruction and examination requirements.

1.4. Notwithstanding paragraph 1.2, for the issue of an LAPL(A), the holder of an LAPL(S) with TMG extension shall demonstrate an adequate level of theoretical knowledge for the single-engine piston aeroplane-land class in accordance with FCL.135.A(a)(2).

2. CPL

2.1. An applicant for a CPL holding a CPL in another category of aircraft shall have received theoretical knowledge bridge instruction on an approved course according to the differences identified between the CPL syllabi for different aircraft categories.

2.2. The applicant shall pass theoretical knowledge examinations as defined in this Part for the following subjects in the appropriate aircraft category:

021 — Aircraft General Knowledge: Airframe and Systems, Electrics, Powerplant, Emergency Equipment,

022 — Aircraft General Knowledge: Instrumentation,

032/034 — Performance Aeroplanes or Helicopters, as applicable,

070 — Operational Procedures, and

080 — Principles of Flight.

2.3. An applicant for a CPL having passed the relevant theoretical examinations for an IR in the same category of aircraft is credited towards the theoretical knowledge requirements in the following subjects:

- Human Performance,

- Meteorology.

3. ATPL

3.1. An applicant for an ATPL holding an ATPL in another category of aircraft shall have received theoretical knowledge bridge instruction at an ATO according to the differences identified between the ATPL syllabi for different aircraft categories.

3.2. The applicant shall pass theoretical knowledge examinations as defined in this Part for the following subjects in the appropriate aircraft category:

021 — Aircraft General Knowledge: Airframe and Systems, Electrics, Powerplant, Emergency Equipment,

022 — Aircraft General Knowledge: Instrumentation,

032/034 — Performance Aeroplanes or Helicopters, as applicable,

070 — Operational Procedures, and

080 — Principles of Flight

3.3. An applicant for an ATPL(A) having passed the relevant theoretical examination for a CPL(A) is credited towards the theoretical knowledge requirements in subject VFR Communications.

3.4. An applicant for an ATPL(H), having passed the relevant theoretical examinations for a CPL(H) is credited towards the theoretical knowledge requirements in the following subjects:

- Air Law,

- Principles of Flight (Helicopter),

- VFR Communications.

3.5. An applicant for an ATPL(A) having passed the relevant theoretical examination for an IR(A) is credited towards the theoretical knowledge requirements in subject IFR Communications.

3.6. An applicant for an ATPL(H) with an IR(H), having passed the relevant theoretical examinations for a CPL(H) is credited towards the theoretical knowledge requirements in the following subjects:

- Principles of Flight (Helicopter),

- VFR Communications.

4. IR

4.1. An applicant for an IR or an EIR having passed the relevant theoretical examinations for a CPL in the same aircraft category is credited towards the theoretical knowledge requirements in the following subjects:

- Human Performance,

- Meteorology.

4.2. An applicant for an IR(H) having passed the relevant theoretical examinations for an ATPL(H) VFR is required to pass the following examination subjects:

- Air Law,

- Flight Planning and Flight Monitoring,

- Radio Navigation,

- IFR Communications.

Appendix 2 - Language Proficiency Rating Scale

Language Proficiency Rating Scale — Expert, extended and operational level

Note: The initial text of Appendix 2 has been transferred to AMC, see also the Explanatory Note.

LEVEL	PRONUNCIATION	STRUCTURE	VOCABULARY	FLUENCY	COMPREHENSION	INTERACTIONS
Expert **(Level 6)**	Pronunciation, stress, rhythm, and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced and sensitive to register.	Able to speak at length with a natural, effortless flow. Varies speech flow for stylistic effect, e.g. to emphasize a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and non-verbal cues, and responds to them appropriately.
Extended **(Level 5)**	Pronunciation, stress, rhythm, and intonation, though influenced by the first language or regional variation, rarely interfere with ease of understanding.	Basic grammatical structures and sentence patterns are consistently well controlled. Complex structures are attempted but with errors which sometimes interfere with meaning.	Vocabulary range and accuracy are sufficient to communicate effectively on common, concrete, and work-related topics. Paraphrases consistently and successfully. Vocabulary is	Able to speak at length with relative ease on familiar topics, but may not vary speech flow as a stylistic device. Can make use of appropriate discourse markers or connectors.	Comprehension is accurate on common, concrete, and work-related topics and mostly accurate when the speaker is confronted with a linguistic or situational complication or an	Responses are immediate, appropriate, and informative. Manages the speaker/listener relationship effectively.

			sometimes idiomatic.		unexpected turn of events. Is able to comprehend a range of speech varieties (dialect and/or accent) or registers.	
Operational **(Level 4)**	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning.	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics. Can often paraphrase successfully when lacking vocabulary particularly in unusual or unexpected circumstances.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers and connectors. Fillers are not distracting.	Comprehension is mostly accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming, or clarifying.

Appendix 3 - Training courses for the issue of a CPL and an ATPL

1. This appendix describes the requirements for the different types of training courses for the issue of a CPL and an ATPL, with and without an IR.

2. An applicant wishing to transfer to another ATO during a training course shall apply to the competent authority for a formal assessment of the further hours of training required.

A. ATP integrated course - Aeroplanes

GENERAL

1. The aim of the ATP(A) integrated course is to train pilots to the level of proficiency necessary to enable them to operate as co-pilot on multi-pilot multi-engine aeroplanes in commercial air transport and to obtain the CPL(A)/IR.

2. An applicant wishing to undertake an ATP(A) integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(A) or PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of a PPL(A) or PPL(H) entrant, 50% of the hours flown prior to the course shall be credited, up to a maximum of 40 hours flying experience, or 45 hours if an aeroplane night rating has been obtained, of which up to 20 hours may count towards the requirement for dual instruction flight time.

4. The course shall comprise:

(a) theoretical knowledge instruction to the ATPL(A) knowledge level;

(b) visual and instrument flying training; and

(c) training in MCC for the operation of multi-pilot aeroplanes.

5. An applicant failing or unable to complete the entire ATP(A) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR if the applicable requirements are met.

THEORETICAL KNOWLEDGE

6. An ATP(A) theoretical knowledge course shall comprise at least 750 hours of instruction.

7. The MCC course shall comprise at least 25 hours of theoretical knowledge instruction and exercises.

THEORETICAL KNOWLEDGE EXAMINATION

8. An applicant shall demonstrate the level of knowledge appropriate to the privileges granted to the holder of an ATPL(A).

FLYING TRAINING

9. The flying training, not including type rating training, shall comprise a total of at least 195 hours, to include all progress tests, of which up to 55 hours for the entire course may be instrument ground time. Within the total of 195 hours, applicants shall complete at least:

(a) 95 hours of dual instruction, of which up to 55 hours may be instrument ground time;

(b) 70 hours as PIC, including VFR flight and instrument flight time as student pilot in-command (SPIC). The instrument flight time as SPIC shall only be counted as PIC flight time up to a maximum of 20 hours;

(c) 50 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 540 km (300 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made;

(d) 5 hours flight time shall be completed at night, comprising 3 hours of dual instruction, which will include at least 1 hour of cross-country navigation and 5 solo take-offs and 5 solo full stop landings; and

(e) 115 hours of instrument time comprising, at least:

(1) 20 hours as SPIC;

(2) 15 hours MCC, for which an FFS or FNPT II may be used;

(3) 50 hours of instrument flight instruction, of which up to:

(i) 25 hours may be instrument ground time in a FNPT I, or

(ii) 40 hours may be instrument ground time in a FNPT II, FTD 2 or FFS, of which up to 10 hours may be conducted in an FNPT I.

An applicant holding a course completion certificate for the Basic Instrument Flight Module shall be credited with up to 10 hours towards the required instrument instruction time. Hours done in a BITD shall not be credited.

(f) 5 hours to be carried out in an aeroplane certificated for the carriage of at least 4 persons that has a variable pitch propeller and retractable landing gear.

SKILL TEST

9. Upon completion of the related flying training, the applicant shall take the CPL(A) skill test on either a single-engine or a multi-engine aeroplane and the IR skill test on a multi-engine aeroplane.

B. ATP modular course – Aeroplanes

1. Applicants for an ATPL(A) who complete their theoretical knowledge instruction at a modular course shall:

(a) hold at least a PPL(A) issued in accordance with Annex 1 to the Chicago Convention; and complete at least the following hours of theoretical knowledge instruction:

(1) for applicants holding a PPL(A): 650 hours;

(2) for applicants holding a CPL(A): 400 hours;

(3) for applicants holding an IR(A): 500 hours;

(4) for applicants holding a CPL(A) and an IR(A): 250 hours.

The theoretical knowledge instruction shall be completed before the skill test for the ATPL(A) is taken.

C. CPL/IR integrated course - Aeroplanes

GENERAL

1. The aim of the CPL(A) and IR(A) integrated course is to train pilots to the level of proficiency necessary to operate single-pilot single-engine or multi-engine aeroplanes in commercial air transport and to obtain the CPL(A)/IR.

2. An applicant wishing to undertake a CPL(A)/IR integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(A) or PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of a PPL(A) or PPL(H) entrant, 50% of the hours flown prior to the course shall be credited, up to a maximum of 40 hours flying experience, or 45 hours if an aeroplane night rating has been obtained, of which up to 20 hours may count towards the requirement for dual instruction flight time.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(A) and IR knowledge level; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL/IR(A) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR if the applicable requirements are met.

THEORETICAL KNOWLEDGE

6. A CPL(A)/IR theoretical knowledge course shall comprise at least 500 hours of

instruction.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(A) and an IR.

FLYING TRAINING

8. The flying training, not including type rating training, shall comprise a total of at least 180 hours, to include all progress tests, of which up to 40 hours for the entire course may be instrument ground time. Within the total of 180 hours, applicants shall complete at least:

(a) 80 hours of dual instruction, of which up to 40 hours may be instrument ground time;

(b) 70 hours as PIC, including VFR flight and instrument flight time which may be flown as SPIC. The instrument flight time as SPIC shall only be counted as PIC flight time up to a maximum of 20 hours;

(c) 50 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 540 km (300 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made;

(d) 5 hours flight time shall be completed at night, comprising 3 hours of dual instruction, which shall include at least 1 hour of cross-country navigation and 5 solo take-offs and 5 solo full stop landings; and

(e) 100 hours of instrument time comprising, at least:

(1) 20 hours as SPIC; and

(2) 50 hours of instrument flight instruction, of which up to:

(i) 25 hours may be instrument ground time in an FNPT I, or

(ii) 40 hours may be instrument ground time in an FNPT II, FTD 2 or FFS, of which up to 10 hours may be conducted in an FNPT I.

An applicant holding a course completion certificate for the Basic Instrument Flight Module shall be credited with up to 10 hours towards the required instrument instruction time. Hours done in a BITD shall not be credited.

(f) 5 hours to be carried out in an aeroplane certificated for the carriage of at least 4 persons that has a variable pitch propeller and retractable landing gear.

SKILL TESTS

10. Upon completion of the related flying training the applicant shall take the CPL(A) skill test and the IR skill test on either a multi-engine aeroplane or a single-engine aeroplane.

D. CPL integrated course - Aeroplanes

GENERAL

1. The aim of the CPL(A) integrated course is to train pilots to the level of proficiency necessary for the issue of a CPL(A).

2. An applicant wishing to undertake a CPL(A) integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(A) or PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of a PPL(A) or PPL(H) entrant, 50% of the hours flown prior to the course shall be credited, up to a maximum of 40 hours flying experience, or 45 hours if an aeroplane night rating has been obtained, of which up to 20 hours may count towards the requirement for dual instruction flight time.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(A) knowledge level; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL(A) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges, if the applicable requirements are met.

THEORETICAL KNOWLEDGE

6. A CPL(A) theoretical knowledge course shall comprise at least 350 hours of instruction.

THEORETICAL KNOWLEGDE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(A).

FLYING TRAINING

8. The flying training, not including type rating training, shall comprise a total of at least 150 hours, to include all progress tests, of which up to 5 hours for the entire course may be instrument ground time. Within the total of 150 hours, applicants shall complete at least:

(a) 80 hours of dual instruction, of which up to 5 hours may be instrument ground time;

(b) 70 hours as PIC;

(c) 20 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 540 km (300 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made;

(d) 5 hours flight time shall be completed at night, comprising 3 hours of dual instruction, which shall include at least 1 hour of cross-country navigation and 5 solo take-offs and 5 solo full stop landings;

(e) 10 hours of instrument flight instruction, of which up to 5 hours may be instrument ground time in an FNPT I, FTD 2, FNPT II or FFS. An applicant holding a course completion certificate for the Basic Instrument Flight Module shall be credited with up to 10 hours towards the required instrument instruction time. Hours done in a BITD shall not be credited;

(f) 5 hours to be carried out in an aeroplane certificated for the carriage of at least four persons that has a variable pitch propeller and retractable landing gear.

SKILL TEST

9. Upon completion of the flying training the applicant shall take the CPL(A) skill test on a single-engine or a multi-engine aeroplane.

E. CPL modular course - Aeroplanes

GENERAL

1. The aim of the CPL(A) modular course is to train PPL(A) holders to the level of proficiency necessary for the issue of a CPL(A).

2. Before commencing a CPL(A) modular course an applicant shall be the holder of a PPL(A) issued in accordance with Annex 1 to the Chicago Convention.

3. Before commencing the flight training the applicant shall:

(a) have completed 150 hours flight time;

(b) have complied with the prerequisites for the issue of a class or type rating for multi-engine aeroplanes in accordance with Subpart H, if a multi-engine aeroplane is to be used on the skill test.

4. An applicant wishing to undertake a modular CPL(A) course shall complete all the flight instructional stages in one continuous course of training as arranged by an ATO. The theoretical knowledge instruction may be given at an ATO conducting theoretical knowledge instruction only.

5. The course shall comprise:

(a) theoretical knowledge instruction to CPL(A) knowledge level; and

(b) visual and instrument flying training.

THEORETICAL KNOWLEDGE

6. An approved CPL(A) theoretical knowledge course shall comprise at least 250 hours of instruction.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(A).

FLYING TRAINING

8. Applicants without an IR shall be given at least 25 hours dual flight instruction, including 10 hours of instrument instruction of which up to 5 hours may be instrument ground time in a BITD, an FNPT I or II, an FTD 2 or an FFS.

9. Applicants holding a valid IR(A) shall be fully credited towards the dual instrument instruction time. Applicants holding a valid IR(H) shall be credited up to 5 hours of the dual instrument instruction time, in which case at least 5 hours dual instrument instruction time shall be given in an aeroplane. An applicant holding a Course Completion Certificate for the Basic Instrument Flight Module shall be credited with up to 10 hours towards the required instrument instruction time.

10. (a) Applicants with a valid IR shall be given at least 15 hours dual visual flight instruction.

(b) Applicants without a night rating aeroplane shall be given additionally at least 5 hours night flight instruction, comprising 3 hours of dual instruction, which shall include at least 1 hour of cross-country navigation and 5 solo take-offs and 5 solo full stop landings.

11. At least 5 hours of the flight instruction shall be carried out in an aeroplane certificated for the carriage of at least 4 persons and have a variable pitch propeller and retractable landing gear.

EXPERIENCE

12. The applicant for a CPL(A) shall have completed at least 200 hours flight time, including at least:

(a) 100 hours as PIC, of which 20 hours of cross-country flight as PIC, which shall include a VFR cross-country flight of at least 540 km (300 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made;

(b) 5 hours of flight time shall be completed at night, comprising 3 hours of dual instruction, which shall include at least 1 hour of cross-country navigation and 5 solo take-offs and 5 solo full stop landings; and

(c) 10 hours of instrument flight instruction, of which up to 5 hours may be instrument ground time in an FNPT I, or FNPT II or FFS. An applicant holding a course completion certificate for the Basic Instrument Flight Module shall be credited with up to 10 hours towards the required instrument instruction time. Hours done in a BITD shall not be credited;

(d) 6 hours of flight time shall be completed in a multi-engine aeroplane, if a multi-engine aeroplane is used for the skill test.

(e) Hours as PIC of other categories of aircraft may count towards the 200 hours flight time, in the following cases:

(i) 30 hours in helicopter, if the applicant holds a PPL(H); or

(ii) 100 hours in helicopters, if the applicant holds a CPL(H); or

(iii) 30 hours in TMGs or sailplanes; or

(iv) 30 hours in airships, if the applicant holds a PPL(As); or

(v) 60 hours in airships, if the applicant holds a CPL(As).

SKILL TEST

13. Upon completion of the flying training and relevant experience requirements the applicant shall take the CPL(A) skill test on either a single-engine or a multi-engine aeroplane.

F. ATP/IR integrated course — Helicopters

GENERAL

1. The aim of the ATP(H)/IR integrated course is to train pilots to the level of proficiency necessary to enable them to operate as co-pilot on multi-pilot multi-engine helicopters in commercial air transport and to obtain the CPL(H)/IR.

2. An applicant wishing to undertake an ATP(H)/IR integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of a PPL(H) entrant, 50% of the relevant experience shall be credited, up to a maximum of:

(a) 40 hours, of which up to 20 hours may be dual instruction; or

(b) 50 hours, of which up to 25 hours may be dual instruction, if a helicopter night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to the ATPL(H) and IR knowledge level;

(b) visual and instrument flying training; and

(c) training in MCC for the operation of multi-pilot helicopters.

5. An applicant failing or unable to complete the entire ATP(H) /IR course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR, if the applicable requirements are met.

Theoretical knowledge

6. An ATP(H)/IR theoretical knowledge course shall comprise at least 750 hours of instruction.

7. The MCC course shall comprise at least 25 hours of theoretical knowledge instruction exercises.

Theoretical knowledge examination

8. An applicant shall demonstrate the level of knowledge appropriate to the privileges granted to the holder of an ATPL(H) and an IR.

Flying training

9. The flying training shall comprise a total of at least 195 hours, to include all progress tests. Within the total of 195 hours, applicants shall complete at least:

(a) 140 hours of dual instruction, of which:

(1) 75 hours visual instruction may include:

(i) 30 hours in a helicopter FFS, level C/D, or

(ii) 25 hours in a FTD 2,3, or

(iii) 20 hours in a helicopter FNPT II/III, or

(iv) 20 hours in an aeroplane or TMG;

50 hours instrument instruction may include:

(i) up to 20 hours in a helicopter FFS or FTD 2,3 or FNPT II/III, or

(ii) 10 hours in at least a helicopter FNPT 1 or an aeroplane;

15 hours MCC, for which a helicopter FFS or helicopter FTD 2,3(MCC) or FNPT II/III(MCC) may be used.

If the helicopter used for the flying training is of a different type from the helicopter FFS used for the visual training, the maximum credit shall be limited to that allocated for the helicopter FNPT II/III.

55 hours as PIC, of which 40 hours may be as SPIC. At least 14 hours solo day and 1 hour solo night shall be made.

50 hours of cross-country flight, including at least 10 hours of cross-country flight as SPIC including a VFR cross-country flight of at least 185 km (100 NM) in the course of which landings at two different aerodromes from the aerodrome of departure shall be made;

(d) 5 hours flight time in helicopters shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing;

(e) 50 hours of dual instrument time comprising:

(i) 10 hours basic instrument instruction time, and

(ii) 40 hours IR Training, which shall include at least 10 hours in a multi-engine IFR-certificated helicopter.

Skill tests

10. Upon completion of the related flying training, the applicant shall take the CPL(H) skill test on a multi-engine helicopter and the IR skill test on an IFR certificated multi-engine helicopter and shall comply with the requirements for MCC training.

G. ATP integrated course — Helicopters

GENERAL

1. The aim of the ATP(H) integrated course is to train pilots to the level of proficiency necessary to enable them to operate as co-pilot on multi-pilot multi-engine helicopters limited to VFR privileges in commercial air transport and to obtain the CPL(H).

2. An applicant wishing to undertake an ATP(H) integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of a PPL(H) entrant, 50% of the relevant experience shall be credited, up to a maximum of:

(a) 40 hours, of which up to 20 hours may be dual instruction; or

(b) 50 hours, of which up to 25 hours may be dual instruction, if a helicopter night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to the ATPL(H) knowledge level;

(b) visual and basic instrument flying training; and

(c) training in MCC for the operation of multi-pilot helicopters.

5. An applicant failing or unable to complete the entire ATP(H) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges, if the applicable requirements are met.

Theoretical knowledge

6. An ATP(H) theoretical knowledge course shall comprise at least 650 hours of instruction.

7. The MCC course shall comprise at least 20 hours of theoretical knowledge instruction exercises.

Theoretical knowledge examination

8. An applicant shall demonstrate the level of knowledge appropriate to the privileges granted to the holder of an ATPL (H).

Flying training

9. The flying training shall comprise a total of at least 150 hours, to include all progress tests. Within the total of 150 hours, applicants shall complete at least:

(a) 95 hours of dual instruction, of which:

(i) 75 hours visual instruction may include:

(1) 30 hours in a helicopter FFS level C/D, or

(2) 25 hours in a helicopter FTD 2,3, or

(3) 20 hours in a helicopter FNPT II/III, or

(4) 20 hours in an aeroplane or TMG;

(ii) 10 hours basic instrument instruction may include 5 hours in at least a helicopter FNPT I or an aeroplane;

(iii) 10 hours MCC, for which a helicopter: helicopter FFS or FTD 2,3(MCC) or FNPT II/III(MCC) may be used.

If the helicopter used for the flying training is of a different type from the helicopter FFS used for the visual training, the maximum credit shall be limited to that allocated for the helicopter FNPT II/III.

(b) 55 hours as PIC, of which 40 hours may be as SPIC. At least 14 hours solo day and 1 hour solo night shall be made;

(c) 50 hours of cross-country flight, including at least 10 hours of cross-country flight as SPIC, including a VFR cross-country flight of at least 185 km (100 NM) in the course of which landings at two different aerodromes from the aerodrome of departure shall be made;

(d) 5 hours flight time in helicopters shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing.

SKILL TESTS

10. Upon completion of the related flying training the applicant shall take the CPL(H) skill test on a multi-engine helicopter and comply with MCC requirements.

H. ATP modular course — Helicopters

1. Applicants for an ATPL(H) who complete their theoretical knowledge instruction at a modular course shall hold at least a PPL(H) and complete at least the following hours of instruction within a period of 18 months:

(a) for applicants holding a PPL(H) issued in accordance with Annex 1 to the Chicago Convention: 550 hours;

(b) for applicants holding a CPL(H): 300 hours.

2. Applicants for an ATPL(H)/IR who complete their theoretical knowledge instruction at a modular course shall hold at least a PPL(H) and complete at least the following hours of instruction:

(a) for applicants holding a PPL(H): 650 hours;

(b) for applicants holding a CPL(H): 400 hours;

(c) for applicants holding an IR(H): 500 hours;

(d) for applicants holding a CPL(H) and an IR(H): 250 hours.

I. CPL/IR integrated course — Helicopters

GENERAL

1. The aim of the CPL(H)/IR integrated course is to train pilots to the level of proficiency necessary to operate single-pilot multi-engine helicopters and to obtain the CPL(H)/IR multi-engine helicopter.

2. An applicant wishing to undertake a CPL(H)/IR integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of an entrant holding a PPL(H), 50% of the relevant experience shall be credited, up to a maximum of:

(a) 40 hours, of which up to 20 hours may be dual instruction; or

(b) 50 hours, of which up to 25 hours may be dual instruction, if a helicopter night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(H) and IR knowledge level, and the initial multi-engine helicopter type rating; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL(H)/IR course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR, if the applicable requirements are met.

Theoretical knowledge

6. A CPL(H)/IR theoretical knowledge course shall comprise at least 500 hours of instruction.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(H) and an IR.

Flying training

8. The flying training shall comprise a total of at least 180 hours including all progress tests. Within the 180 hours, applicants shall complete at least:

(a) 125 hours of dual instruction, of which:

(i) 75 hours visual instruction, which may include:

(1) 30 hours in a helicopter FFS level C/D, or

(2) 25 hours in a helicopter FTD 2,3, or

(3) 20 hours in a helicopter FNPT II/III, or

(4) 20 hours in an aeroplane or TMG;

(ii) 50 hours instrument instruction which may include:

(1) up to 20 hours in a helicopter FFS or FTD 2,3, or FNPT II,III, or

(2) 10 hours in at least a helicopter FNPT I or an aeroplane.

If the helicopter used for the flying training is of a different type from the FFS used for the visual training, the maximum credit shall be limited to that allocated for the FNPT II/III.

(b) 55 hours as PIC, of which 40 hours may be as SPIC. At least 14 hours solo day and 1 hour solo night shall be made;

(c) 10 hours dual cross-country flying;

(d) 10 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 185 km (100 NM) in the course of which full stop landings at two different aerodromes from the aerodrome of departure shall be made;

(e) 5 hours of flight time in helicopters shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing;

(f) 50 hours of dual instrument time comprising:

(i) 10 hours basic instrument instruction time; and

(ii) 40 hours IR Training, which shall include at least 10 hours in a multiengine IFR-certificated helicopter.

Skill test

9. Upon completion of the related flying training, the applicant shall take the CPL(H) skill test on either a multi-engine or a single-engine helicopter and the IR skill test on an IFR-certificated multi-engine helicopter.

J. CPL integrated course — Helicopters

GENERAL

1. The aim of the CPL(H) integrated course is to train pilots to the level of proficiency necessary for the issue of a CPL(H).

2. An applicant wishing to undertake a CPL(H) integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of an entrant holding a PPL(H), 50% of the relevant experience shall be credited, up to a maximum of:

(a) 40 hours, of which up to 20 hours may be dual instruction; or

(b) 50 hours, of which up to 25 hours may be dual instruction if a helicopter night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(H) knowledge level; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL(H) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges, if the applicable requirements are met.

Theoretical knowledge

6. An approved CPL(H) theoretical knowledge course shall comprise at least 350 hours of instruction or 200 hours if the applicant is the holder of a PPL.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(H).

Flying training

8. The flying training shall comprise a total of at least 135 hours, to include all progress tests, of which up to 5 hours may be instrument ground time. Within the 135 hours total, applicants shall complete at least:

(a) 85 hours of dual instruction, of which:

(i) up to 75 hours may be visual instruction, and may include:

(1) 30 hours in a helicopter FFS level C/D, or

(2) 25 hours in a helicopter FTD 2,3, or

(3) 20 hours in a helicopter FNPT II/III, or

(4) 20 hours in an aeroplane or TMG.

(ii) up to 10 hours may be instrument instruction, and may include 5 hours in at least a helicopter FNPT I or an aeroplane.

If the helicopter used for the flying training is of a different type from the FFS used for the visual training, the maximum credit shall be limited to that allocated for the FNPT II/III.

(b) 50 hours as PIC, of which 35 hours may be as SPIC. At least 14 hours solo day and 1 hour solo night shall be made;

(c) 10 hours dual cross-country flying;

(d) 10 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 185 km (100 NM) in the course of which full stop landings at two different aerodromes from the aerodrome of departure shall be made;

(e) 5 hours flight time in helicopters shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing;

(f) 10 hours of instrument dual instruction time, including at least 5 hours in a helicopter.

Skill test

9. Upon completion of the related flying training, the applicant shall take the CPL(H) skill test.

K. CPL modular course — Helicopters

GENERAL

1. The aim of the CPL(H) modular course is to train PPL(H) holders to the level of proficiency necessary for the issue of a CPL(H).

2. Before commencing a CPL(H) modular course an applicant shall be the holder of a PPL(H) issued in accordance with Annex 1 to the Chicago Convention.

3. Before commencing the flight training the applicant shall:

(a) have completed 155 hours flight time, including 50 hours as PIC in helicopters of which 10 hours shall be cross-country. Hours as PIC of other categories of aircraft may count towards the 155 hours flight time as prescribed in paragraph 11 of Section K;

(b) have complied with FCL.725 and FCL.720.H if a multi-engine helicopter is to be used on the skill test.

4. An applicant wishing to undertake a modular CPL(H) course shall complete all the flight instructional stages in one continuous course of training as arranged by an ATO. The theoretical knowledge instruction may be given at an ATO that conducts theoretical knowledge instruction only.

5. The course shall comprise:

(a) theoretical knowledge instruction to CPL(H) knowledge level; and

(b) visual and instrument flying training.

Theoretical knowledge

6. An approved CPL(H) theoretical knowledge course shall comprise at least 250 hours of instruction.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(H).

FLYING TRAINING

8. Applicants without an IR shall be given at least 30 hours dual flight instruction, of which:

(a) 20 hours visual instruction, which may include 5 hours in a helicopter FFS or FTD 2,3 or FNPT II,III; and

(b) 10 hours instrument instruction, which may include 5 hours in at least a helicopter FTD 1 or FNPT I or aeroplane.

9. Applicants holding a valid IR(H) shall be fully credited towards the dual instrument instruction time. Applicants holding a valid IR(A) shall complete at least 5 hours of the dual instrument instruction time in a helicopter.

10. Applicants without a night rating helicopter shall be given additionally at least 5 hours night flight instruction comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing.

Experience

10. The applicant for a CPL(H) shall have completed at least 185 hours flight time, including 50 hours as PIC, of which 10 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 185 km (100 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made.

11. The applicant for a CPL(H) shall have completed at least 185 hours flight time, including 50 hours as PIC, of which 10 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 185 km (100 NM), in the course of which full stop landings at two aerodromes different from the aerodrome of departure shall be made.

Hours as pilot-in-command of other categories of aircraft may count towards the 185 hours flight time, in the following cases:

(a) 20 hours in aeroplanes, if the applicant holds a PPL(A); or

(b) 50 hours in aeroplanes, if the applicant holds a CPL(A); or

(c) 10 hours in TMGs or sailplanes; or

(d) 20 hours in airships, if the applicant holds a PPL(As); or

(e) 50 hours in airships, if the applicant holds a CPL(As).

Skill test

12. Upon completion of the related flying training and relevant experience, the applicant shall take the CPL(H) skill test.

L. CPL/IR integrated course — Airships

GENERAL

1. The aim of the CPL(As)/IR integrated course is to train pilots to the level of proficiency necessary to operate airships and to obtain the CPL(As)/IR.

2. An applicant wishing to undertake a CPL(As)/IR integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(As), PPL(A) or PPL(H) issued in accordance with Annex 1 to the Chicago Convention. In the case of an entrant holding a PPL(As), PPL(A) or PPL(H) shall be credited up to a maximum of:

(a) 10 hours, of which up to 5 hours may be dual instruction; or

(b) 15 hours, of which up to 7 hours may be dual instruction, if an airship night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(As) and IR knowledge level, and the initial airship type rating; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL/IR(As) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR, if the applicable requirements are met.

Theoretical knowledge

6. A CPL(As)/IR theoretical knowledge course shall comprise at least 500 hours of instruction.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(As) and an IR.

Flying training

8. The flying training shall comprise a total of at least 80 hours including all progress tests. Within the 80 hours, applicants shall complete at least:

(a) 60 hours of dual instruction, of which:

(i) 30 hours visual instruction, which may include:

(1) 12 hours in an airship FFS, or

(2) 10 hours in an airship FTD, or

(3) 8 hours in an airship FNPT II/III, or

(4) 8 hours in an aeroplane, helicopter or TMG;

(ii) 30 hours instrument instruction which may include:

(1) up to 12 hours in an airship FFS or FTD or FNPT II,III, or

(2) 6 hours in at least a airship FTD 1 or FNPT I or aeroplane.

If the airship used for the flying training is of a different type from the FFS used for the visual training, the maximum credit shall be limited to 8 hours.

(b) 20 hours as PIC, of which 5 hours may be as SPIC. At least 14 hours solo day and 1 hour solo night shall be made;

(c) 5 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 90 km (50 NM) in the course of which two full stop landings at the destination aerodrome shall be made;

(d) 5 hours flight time in airships shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include take-off and landing;

(e) 30 hours of dual instrument time comprising:

(i) 10 hours basic instrument instruction time; and

(ii) 20 hours IR Training, which shall include at least 10 hours in a multiengine IFR-certificated airship.

Skill test

9. Upon completion of the related flying training, the applicant shall take the CPL(As) skill test on either a multi-engine or a single-engine airship and the IR skill test on an IFR-certificated multi-engine airship.

M. CPL integrated course — Airships

GENERAL

1. The aim of the CPL(As) integrated course is to train pilots to the level of proficiency necessary for the issue of a CPL(AS).

2. An applicant wishing to undertake a CPL(As) integrated course shall complete all the instructional stages in one continuous course of training as arranged by an ATO.

3. An applicant may be admitted to training either as an ab-initio entrant, or as a holder of a PPL(As), PPL(A) or PPL(H) issued in accordance with Annex 1 to the

Chicago Convention. In the case of an entrant holding a PPL(As), PPL(A) or PPL(H) shall be credited up to a maximum of:

(a) 10 hours, of which up to 5 hours may be dual instruction; or

(b) 15 hours, of which up to 7 hours may be dual instruction if a airship night rating has been obtained.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(As) knowledge level; and

(b) visual and instrument flying training.

5. An applicant failing or unable to complete the entire CPL(As) course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges, if the applicable requirements are met.

Theoretical knowledge

6. An approved CPL(As) theoretical knowledge course shall comprise at least 350 hours of instruction or 200 hours if the applicant is a PPL holder.

THEORETICAL KNOWLEDGE EXAMINATION

7. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(As).

Flying training

8. The flying training shall comprise a total of at least 50 hours, to include all progress tests, of which up to 5 hours may be instrument ground time. Within the 50 hours total, applicants shall complete at least:

(a) 30 hours of dual instruction, of which up to 5 hours may be instrument ground time;

(b) 20 hours as PIC;

(c) 5 hours dual cross-country flying;

(d) 5 hours of cross-country flight as PIC, including a VFR cross-country flight of at least 90 km (50 NM) in the course of which two full stop landings at the destination aerodrome shall be made;

(e) 5 hours flight time in airships shall be completed at night comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include take-off and landing;

(f) 10 hours of instrument dual instruction time, including at least 5 hours in an airship.

Skill test

9. Upon completion of the related flying training, the applicant shall take the CPL(As) skill test.

N. CPL modular course — Airships

GENERAL

1. The aim of the CPL(As) modular course is to train PPL(As) holders to the level of proficiency necessary for the issue of a CPL(As).

2. Before commencing a CPL(As) modular course an applicant shall:

(a) hold a PPL(As) issued in accordance with Annex 1 to the Chicago Convention;

(b) have completed 200 hours flight time as a pilot on airships, including 100 hours as PIC, of which 50 hours shall be cross-country.

3. An applicant wishing to undertake a modular CPL(As) course shall complete all the flight instructional stages in one continuous course of training as arranged by an ATO. The theoretical knowledge instruction may be given at an ATO that conducts theoretical knowledge instruction only.

4. The course shall comprise:

(a) theoretical knowledge instruction to CPL(As) knowledge level; and

(b) visual and instrument flying training.

Theoretical knowledge

5. An approved CPL(As) theoretical knowledge course shall comprise at least 250 hours of instruction.

THEORETICAL KNOWLEDGE EXAMINATION

6. An applicant shall demonstrate a level of knowledge appropriate to the privileges granted to the holder of a CPL(As).

FLYING TRAINING

7. Applicants without an IR shall be given at least 20 hours dual flight instruction, of which:

10 hours visual instruction, which may include 5 hours in an airship FFS or FTD 2,3 or FNPT II,III; and

10 hours instrument instruction, which may include 5 hours in at least an airship FTD 1 or FNPT I or aeroplane.

8. Applicants holding a valid IR(As) shall be fully credited towards the dual instrument instruction time. Applicants holding a valid IR in another category of aircraft shall complete at least 5 hours of the dual instrument instruction time in an airship.

9. Applicants without a night rating airship shall be given additionally at least 5 hours night flight instruction comprising 3 hours of dual instruction including at least 1 hour of cross-country navigation and 5 solo night circuits. Each circuit shall include a take-off and a landing.

EXPERIENCE

10. The applicant for a CPL(As) shall have completed at least 250 hours flight time in airships, including 125 hours as PIC, of which 50 hours of cross-country flight as PIC, including a VFR cross-

country flight of at least 90 km (50 NM), in the course of which a full stop landing at destination aerodrome.

Hours as PIC of other categories of aircraft may count towards the 185 hours flight time, in the following cases;

(a) 30 hours in aeroplanes or helicopters, if the applicant holds a PPL(A) or PPL(H) respectively; or

(b) 60 hours in aeroplanes or helicopters, if the applicant holds a CPL(A) or CPL(H) respectively; or

(c) 10 hours in TMGs or sailplanes; or

(d) 10 hours in balloons.

Skill test

11. Upon completion of the related flying training and relevant experience, the applicant shall take the CPL(As) skill test.

AMC1 to Appendix 3 Training courses for the issue of a CPL and an ATPL

GENERAL

(a) When ensuring that the applicant complies with the prerequisites for the course, in accordance with ORA.ATO.145, the ATO should check that the applicant has enough knowledge of mathematics, physics and English to facilitate the understanding of the theoretical knowledge instruction content of the course.

(b) Whenever reference is made to a certain amount of hours of training, this means a full hour. Time not directly assigned to training (such as breaks, etc.) is not to be counted towards the total amount of time that is required.

A. ATP integrated course: aeroplanes

(a) The ATP integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for previous experience given to an applicant who already holds a PPL should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 750 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	40 hours
(2)	Aircraft general knowledge	80 hours
(3)	Flight performance and planning	90 hours

(4)	Human performance and limitations	50 hours
(5)	Meteorology	60 hours
(6)	Navigation	150 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flying instruction is divided into five phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at critically low air speeds, recognition of recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency procedures and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(viii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 5 hours of dual instruction and at least 40 hours as PIC.

The dual instruction and testing up to the VFR navigation progress test should comprise:

(i) repetition of exercises of phases 1 and 2;

(ii) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(iii) VFR navigation progress test conducted by an FI not connected with the applicant's training;

(iv) night flight time including take-offs and landings as PIC.

(4) phase 4:

Exercises up to the instrument rating skill test comprise:

(i) at least 55 hours instrument flight, which may contain up to 25 hours of instrument ground time in an FNPT I or up to 40 hours in an FNPT II or FFS which should be conducted by an FI or an authorised SFI;

(ii) 20 hours instrument time flown as SPIC;

(iii) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(iv) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedures;

(G) landings from instrument approaches, including circling.

(v) in-flight manoeuvres and specific flight characteristics;

(vi) operation of an ME aeroplane in the exercises of (iv), including operation of the aeroplane solely by reference to instruments with one engine simulated inoperative, and engine shut-down and restart (the latter training should be at a safe altitude unless carried out in an FSTD).

(5) phase 5:

(i) instruction and testing in MCC comprise the relevant training requirements;

(ii) if a type rating for MP aeroplanes is not required on completion of this part, the applicant will be provided with a certificate of course completion for MCC training.

B. ATP modular theoretical knowledge course: aeroplanes

(a) The aim of this course is to train pilots who have not received the theoretical knowledge instruction during an integrated course to the level of theoretical knowledge required for the ATPL.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

(c) The ATP modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

C. CPL/IR integrated course: aeroplanes

(a) The CPL/IR integrated course should last between 9 and 30 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for previous experience given to an applicant who already holds a PPL should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 500 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 500 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	50 hours
(3)	Flight performance and planning	60 hours
(4)	Human performance and limitations	15 hours
(5)	Meteorology	40 hours
(6)	Navigation	100 hours
(7)	Operational procedures	10 hours
(8)	Principles of flight	25 hours
(9)	Communications	30 hours

Other subdivisions of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flying instruction is divided into four phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane, including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at critically low air speeds, recognition of and recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency operations and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(viii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 5 hours of instruction and at least 40 hours as PIC.

The dual instruction and testing up to the VFR navigation progress test and the skill test should contain the following:

(i) repetition of exercises of phases 1 and 2;

(ii) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(iii) VFR navigation progress test conducted by an FI not connected with the applicant's training;

(iv) night flight time including take-offs and landings as PIC.

(4) phase 4:

Exercises up to the instrument rating skill test comprise:

(i) at least 55 hours instrument time, which may contain up to 25 hours of instrument ground time in an FNPT I or up to 40 hours in an FNPT II or FFS which should be conducted by an FI or an authorised SFI;

(ii) 20 hours instrument time flown as SPIC;

(iii) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(iv) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedures;

(G) landings from instrument approaches, including circling.

(v) in-flight manoeuvres and particular flight characteristics;

(vi) operation of either an SE or an ME aeroplane in the exercises of (iv), including in the case of an ME aeroplane operation of the aeroplane solely by reference to instruments with one engine simulated inoperative and engine shut-down and restart. The latter exercise is to be conducted at a safe altitude unless carried out in an FSTD.

D. CPL integrated course: aeroplanes

(a) The CPL integrated course should last between 9 and 24 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 350 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The flying instruction is divided into four phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane, including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at relatively slow air speeds, recognition of and recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency procedures and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(vii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 30 hours instruction and at least 58 hours as PIC, including:

(a) at least 10 hours instrument time, which may contain 5 hours of instrument ground time in an FNPT or an FFS and should be conducted by an FI or an authorised SFI;

(b) repetition of exercises of phases 1 and 2, which should include at least 5 hours in an aeroplane certificated for the carriage of at least four persons and have a variable pitch propeller and retractable landing gear;

(c) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(d) night flight time including take-offs and landings as PIC.

(4) phase 4:

The dual instruction and testing up to the CPL(A) skill test contain the following:

(i) up to 30 hours instruction which may be allocated to specialised aerial work training;

(ii) repetition of exercises in phase 3, as required;

(iii) in-flight manoeuvres and particular flight characteristics;

(iv) ME training.

If required, operation of an ME aeroplane including operation of the aeroplane with one engine simulated inoperative, and engine shutdown and restart (the latter exercise at a safe altitude unless carried out in an FSTD).

E. CPL modular course: aeroplanes

(a) The CPL modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

THEORETICAL KNOWLEDGE

(c) The 250 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The following flight time is suggested for the flying training:

(1)	visual flight training:	suggested flight time
(i)	Exercise 1: pre-flight operations: mass and balance determination, aeroplane inspection and servicing.	
(ii)	Exercise 2: take-off, traffic pattern, approach and landing, use of checklist, collision avoidance and checking procedures.	0:45 hours
(iii)	Exercise 3: traffic patterns: simulated engine failure during and after take-off.	0:45 hours
(iv)	Exercise 4: maximum performance (short field and obstacle clearance) take-offs and short-field landings.	1:00 hours
(v)	Exercise 5: crosswind take-offs, landings and go-arounds.	1:00 hours
(vi)	Exercise 6: flight at relatively critical high air speeds; recognition of and	0:45 hours

recovery from spiral dives.

(vii) Exercise 7:

flight at critically slow air speeds, spin avoidance, recognition of and recovery from incipient and full stalls.	0:45 hours

(viii) Exercise 8:

cross-country flying using DR and radio navigation aids; flight planning by the applicant; filing of ATC flight plan; evaluation of weather briefing documentation, NOTAM, etc.; R/T procedures and phraseology; positioning by radio navigation aids; operation to, from and transiting controlled aerodromes, compliance with ATS procedures for VFR flights, simulated radio communication failure, weather deterioration, diversion procedures; simulated engine failure during cruise flight; selection of an emergency landing strip.	10:00 hours

(2) instrument flight training:

(i) This module is identical to the 10 hours basic instrument flight module as set out in AMC2 to Appendix 6. This module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitudes.

(ii) All exercises may be performed in an FNPT I or II or an FFS. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(iii) A BITD may be used for the following exercises: (9), (10), (11), (12), (14) and (16).

(iv) The use of the BITD is subject to the following:

(A) the training is complemented by exercises on an aeroplane;

(B) the record of the parameters of the flight is available;

(C) an FI(A) or IRI(A) conducts the instruction.

(v) Exercise 9:

Basic instrument flying without external visual cues; horizontal flight; power changes for acceleration or deceleration, maintaining straight and level flight; turns in level flight with 15 ° and 25 ° bank, left and right; roll-out onto predetermined headings.	0:30 hours

(vi) Exercise 10:

Repetition of exercise 9; additionally climbing and descending, maintaining heading and speed, transition to horizontal flight; climbing and descending turns.	0:45 hours

(vii) Exercise 11:

Instrument pattern:	0:45 hours

(1) start exercise, decelerate to approach speed, flaps into approach configuration;

(2) initiate standard turn (left or right);

(3) roll out on opposite heading, maintain new heading for 1 minute;

(4) standard turn, gear down, descend 500 ft/min;

(5) roll out on initial heading, maintain descent (500 ft/min) and new heading for 1 minute;

(6) transition to horizontal flight, 1.000 ft below initial flight level;

(7) initiate go-around;

(8) climb at best rate of climb speed.

(viii) Exercise 12:

Repetition of exercise 9 and steep turns with 45° bank; recovery from unusual attitudes.	0:45 hours

(ix) Exercise 13:

Repetition of exercise 12	0:45 hours

(x) Exercise 14:

Radio navigation using VOR, NDB or, if available, VDF; interception of predetermined QDM and QDR.	0:45 hours

(xi) Exercise 15:

Repetition of exercise 9 and recovery from unusual attitudes.	0:45 hours

(xii) Exercise 16:

Repetition of exercise 9, turns and level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.	0:45 hours

(xiii) Exercise 17:

Recognition of, and recovery from, incipient and full stalls.	0:45 hours

(xiv) Exercise 18:

Repetition of exercises (14), (16) and (17).	3:30 hours

(3) ME training

If required, operation of an ME aeroplane in the exercises 1 through 18, including operation of the aeroplane with one engine simulated inoperative, and engine shutdown and restart. Before commencing training, the applicant should have complied with the type and class ratings requirements as appropriate to the aeroplane used for the test.

F. ATP/IR integrated course: helicopters

(a) The ATP/IR integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 750 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	40 hours
(2)	Aircraft general knowledge	80 hours
(3)	Flight performance and planning	90 hours
(4)	Human performance and limitations	50 hours
(5)	Meteorology	60 hours
(6)	Navigation	150 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

(d) The flight instruction is divided into four phases:

(1) phase 1:

Flight exercises up to the first solo flight comprise a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations, mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check, and basic instrument flying progress check. This phase comprises a total flight time of not less than 128 hours including 73 hours of dual flight instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as student PIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) advanced/touchdown auto-rotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of a 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes; compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Flight exercises up to IR skill test. This part comprises a total of 40 hours dual instrument flight time, including 10 hours of an ME IFR certificated helicopter.

The instruction and testing should contain the following:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(ii) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedure;

(G) landings from instrument approaches;

(H) in-flight manoeuvres and particular flight characteristics;

(I) instrument exercises with one engine simulated inoperative.

(4) phase 4:

Instruction in MCC should comprise the relevant training set out in FCL.735.H and AMC1 FCL,735.A, FCL.735.H and FCL.735.As.

If a type rating for MP helicopter is not required on completion of this part, the applicant should be provided with a certificate of course completion for MCC training.

G. ATP integrated course: helicopters

(a) The ATP integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 650 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 650 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	70 hours
(3)	Flight performance and planning	65 hours
(4)	Human performance and limitations	40 hours
(5)	Meteorology	40 hours
(6)	Navigation	120 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	25 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

(d) The flight instruction is divided into three phases:

(1) phase 1:

Flight exercises up to the first solo flight comprise a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations, mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress and basic instrument flying progress check conducted by an FI not connected with the applicant's training. This phase comprises a total flight time of not less than 128 hours, including 73 hours of dual instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as student PIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including low level operations to and from unprepared sites;

(vii) 10 hours flight by sole reference to basic flight instruments, including completion of a 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Instruction in MCC comprises the relevant training set out in FCL.735.H and AMC1 FCL,735.A, FCL.735.H and FCL.735.As.

If a type rating for MP helicopter is not required on completion of this part, the applicant should be provided with a certificate of course completion for MCC training.

H. ATP modular theoretical knowledge course: helicopters

(a) The aim of this course is to train pilots who have not received the theoretical knowledge instruction during an integrated course to the level of theoretical knowledge required for the ATPL.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

(c) The ATP modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

I. CPL/IR integrated course: helicopters

(a) The CPL/IR integrated course should last between 9 and 30 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 500 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 500 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	50 hours
(3)	Flight performance and planning	60 hours
(4)	Human performance and limitations	15 hours
(5)	Meteorology	40 hours
(6)	Navigation	100 hours
(7)	Operational procedures	10 hours
(8)	Principles of flight	25 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flight instruction is divided into three phases:

(1) phase 1:

Flight exercises up to the first solo flight. This part comprises a total of at least 12 hours dual flight instruction on a helicopter including:

(i) pre-flight operations: mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotation, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check conducted by an FI not connected with the applicant's training, and basic instrument progress check. This part comprises a total flight time of not less than 128 hours, including 73 hours of dual instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as SPIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotation and simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including selection of and low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of 180 degree turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids and diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Flight exercises up to IR skill test. This part comprises a total of 40 hours dual instrument flight time, including 10 hours of an ME IFR certificated helicopter.

The instruction and testing should contain the following:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(ii) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedure;

(G) landings from instrument approaches;

(H) in-flight manoeuvres and particular flight characteristics;

(I) instrument exercises with one engine simulated inoperative.

J. CPL integrated course: helicopters

(a) The CPL integrated course should last between 9 and 24 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 350 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 350 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	25 hours
(2)	Aircraft general knowledge	30 hours
(3)	Flight performance and planning	25 hours
(4)	Human performance and limitations	10 hours
(5)	Meteorology	30 hours
(6)	Navigation	55 hours
(7)	Operational procedures	8 hours
(8)	Principles of flight	20 hours
(9)	Communications	10 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flight instruction is divided into two phases:

(1) phase 1:

Flight exercises up to the first solo flight. This part comprises a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations: mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check conducted by an FI not connected with the applicant's training, and basic instrument progress check. This part comprises a total flight time of not less than 123 hours, including 73 hours of dual instruction flight time, 15 hours of solo flight and 35 hours flown as SPIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotations and simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including selection of and low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of a 180° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

K. CPL modular course: helicopters

(a) The CPL modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

(b) An approved course should include formal classroom work and may include the use of facilities such as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

THEORETICAL KNOWLEDGE

(c) The 250 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The flying instruction comprises the following items. The flight time allocated to each exercise is at the discretion of the FI, provided that at least 5 hours flight time is allocated to cross-country flying.

VISUAL INSTRUCTION

(e) Within the total of dual flight instruction time, the applicant may have completed during the visual phase up to 5 hours in a helicopter FFS or FTD 2, 3 or FNPT II, III.

(1) pre-flight operations: mass and balance calculations, helicopter inspection and servicing;

(2) level flight speed changes, climbing, descending, turns, basic auto-rotations, use of checklist, collision avoidance and checking procedures;

(3) take-offs and landings, traffic pattern, approach, simulated engine failures in the traffic pattern. Sideways and backwards flight and spot turns in the hover;

(4) recovery from incipient vortex ring condition;

(5) advanced auto-rotations covering the speed range from low speed to maximum range and manoeuvre in auto-rotations (180 °, 360 ° and 'S' turns) and simulated engine-off landings;

(6) selection of emergency landing areas, auto-rotations following simulated emergencies to given areas and steep turns at 30 ° and 45 ° bank;

(7) manoeuvres at low level and quick-stops;

(8) landings, take-offs and transitions to and from the hover when heading out of wind;

(9) landings and take-offs from sloping or uneven ground;

(10) landings and take-offs with limited power;

(11) low level operations into and out of confined landing sites;

(12) cross-country flying using dead reckoning and radio navigation aids, flight planning by the applicant, filing of ATC flight plan, evaluation of weather briefing documentation, NOTAM, etc., R/T procedures and phraseology, positioning by radio navigation aids; operation to, from and transiting controlled aerodromes, compliance with ATS procedures for VFR flights, simulated radio communication failure, weather deterioration, diversion procedures; location of an off airfield landing site and simulated approach.

BASIC INSTRUMENT INSTRUCTION

(f) A maximum of 5 hours of the following exercises may be performed in an FFS or FTD or FNPT. Flight training should be carried out in VMC using a suitable means of simulating IMC for the student.

(1) Exercise 1:

Instrument flying without external visual cues. Level flight performing speed changes, maintaining flight altitude (level, heading) turns in level flight at rate 1 and 30° bank, left and right; roll-out on predetermined headings;

(2) Exercise 2:

repetition of exercise 1; additionally climbing and descending, maintaining heading and speed, transition to horizontal flight; climbing and descending turns;

(3) Exercise 3:

repetition of exercise 1; and recovery from unusual attitudes;

(4) Exercise 4:

radio navigation;

(5) Exercise 5:

repetition of exercise 1; and turns using standby magnetic compass and standby artificial horizon (if fitted).

GM1 to Appendix 3; Appendix 6; FCL.735.H

Appendix 4 - Skill test for the issue of a CPL

A. General

1. An applicant for a skill test for the CPL shall have received instruction on the same class or type of aircraft to be used in the test.

2. An applicant shall pass all the relevant sections of the skill test. If any item in a section is failed, that section is failed. Failure in more than one section will require the applicant to take the entire test again. An applicant failing only in one section shall only repeat the failed section. Failure in any section of the retest, including those sections that have been passed on a previous attempt, will require the applicant to take the entire test again. All relevant sections of the skill test shall be completed within 6 months. Failure to achieve a pass in all relevant sections of the test in two attempts will require further training.

3. Further training may be required following any failed skill test. There is no limit to the number of skill tests that may be attempted.

CONDUCT OF THE TEST

4. Should the applicant choose to terminate a skill test for reasons considered inadequate by the Flight Examiner (FE), the applicant shall retake the entire skill test. If the test is terminated for reasons considered adequate by the FE, only those sections not completed shall be tested in a further flight.

5. At the discretion of the FE, any manoeuvre or procedure of the test may be repeated once by the applicant. The FE may stop the test at any stage if it is considered that the applicant's demonstration of flying skills requires a complete re-test.

6. An applicant shall be required to fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if no other crew member is present. Responsibility for the flight shall be allocated in accordance with national regulations.

7. An applicant shall indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks shall be completed in accordance with the checklist for the aircraft on which the test is being taken. During pre-flight preparation for the test, the applicant is required to determine power settings and speeds. Performance data for take-off, approach and landing shall be calculated by the applicant in compliance with the operations manual or flight manual for the aircraft used.

8. The FE shall take no part in the operation of the aircraft except where intervention is necessary in the interests of safety or to avoid unacceptable delay to other traffic.

B. Content of the skill test for the issue of a CPL — Aeroplanes

1. The aeroplane used for the skill test shall meet the requirements for training aeroplanes, and shall be certificated for the carriage of at least four persons, have a variable pitch propeller and retractable landing gear.

2. The route to be flown shall be chosen by the FE and the destination shall be a controlled aerodrome. The applicant shall be responsible for the flight planning and shall ensure that all equipment and documentation for the execution of the flight are on board. The duration of the flight shall be at least 90 minutes.

3. The applicant shall demonstrate the ability to:

(a) operate the aeroplane within its limitations,

(b) complete all manoeuvres with smoothness and accuracy,

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge; and

(e) maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

FLIGHT TEST TOLERANCES

4. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the aeroplane used.

Height

normal flight ±100 feet
with simulated engine failure ±150 feet

Tracking on radio aids ±5°

Heading

normal flight ±10°
with simulated engine failure ±15°

Speed

take-off and approach ±5 knots
all other flight regimes ±10 knots

CONTENT OF THE TEST

5. Items in section 2 (c) and (e)(iv), and the whole of sections 5 and 6 may be performed in an FNPT II or an FFS.

Use of the aeroplane checklists, airmanship, control of the aeroplane by external visual reference, anti-icing/de-icing procedures and principles of threat and error management apply in all sections.

SECTION 1 — PRE-FLIGHT OPERATIONS AND DEPARTURE	
a	Pre-flight, including: Flight planning, Documentation, Mass and balance determination, Weather brief, NOTAMS
b	Aeroplane inspection and servicing
c	Taxiing and take-off

d	Performance considerations and trim
e	Aerodrome and traffic pattern operations
f	Departure procedure, altimeter setting, collision avoidance (lookout)
g	ATC liaison – compliance, R/T procedures
SECTION 2 GENERAL AIRWORK	
a	Control of the aeroplane by external visual reference, including straight and level, climb, descent, lookout
b	Flight at critically low airspeeds including recognition of and recovery from incipient and full stalls
c	Turns, including turns in landing configuration. Steep turns 45°
d	Flight at critically high airspeeds, including recognition of and recovery from spiral dives
e	Flight by reference solely to instruments, including: (i) level flight, cruise configuration, control of heading, altitude and airspeed (ii) climbing and descending turns with 10°–30° bank (iii) recoveries from unusual attitudes (iv) limited panel instruments
f	ATC liaison – compliance, R/T procedures
SECTION 3 — EN-ROUTE PROCEDURES	
a	Control of aeroplane by external visual reference, including cruise configuration Range/Endurance considerations
b	Orientation, map reading
c	Altitude, speed, heading control, lookout
d	Altimeter setting. ATC liaison – compliance, R/T procedures

e	Monitoring of flight progress, flight log, fuel usage, assessment of track error and re-establishment of correct tracking
f	Observation of weather conditions, assessment of trends, diversion planning
g	Tracking, positioning (NDB or VOR), identification of facilities (instrument flight). Implementation of diversion plan to alternate aerodrome (visual flight)
SECTION 4 — APPROACH AND LANDING PROCEDURES	
a	Arrival procedures, altimeter setting, checks, lookout
b	ATC liaison - compliance, R/T procedures
c	Go-around action from low height
d	Normal landing, crosswind landing (if suitable conditions)
e	Short field landing
f	Approach and landing with idle power (single-engine only)
g	Landing without use of flaps
h	Post flight actions
SECTION 5 — ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (at a safe altitude), fire drill
b	Equipment malfunctions including alternative landing gear extension, electrical and brake failure
c	Forced landing (simulated)
d	ATC liaison - compliance, R/T procedures

e	Oral questions
SECTION 6 — SIMULATED ASYMMETRIC FLIGHT AND RELEVANT CLASS OR TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in an FFS)
b	Asymmetric approach and go-around
c	Asymmetric approach and full stop landing
d	Engine shutdown and restart
e	ATC liaison – compliance, R/T procedures, Airmanship
f	As determined by the FE — any relevant items of the class or type rating skill test to include, if applicable: (i) aeroplane systems including handling of autopilot (ii) operation of pressurisation system (iii) use of de-icing and anti-icing system
g	Oral questions

C. Content of the skill test for the issue of the CPL — Helicopters

1. The helicopter used for the skill test shall meet the requirements for training helicopters.

2. The area and route to be flown shall be chosen by the FE and all low level and hover work shall be at an approved aerodrome/site. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome and one destination shall be a controlled aerodrome. The skill test may be conducted in 2 flights. The total duration of the flight(s) shall be at least 90 minutes.

3. The applicant shall demonstrate the ability to:

(a) operate the helicopter within its limitations;

(b) complete all manoeuvres with smoothness and accuracy;

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge; and

(e) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

Flight test tolerances

4. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the helicopter used.

Height

normal flight ±100 feet

simulated major emergency ±150 feet

Tracking on radio aids ±10°

Heading

normal flight ±10°

simulated major emergency ±15°

Speed

take-off and approach multi-engine ±5 knots

all other flight regimes ±10 knots

Ground drift

T.O. hover I.G.E. ±3 feet

landing no sideways or backwards movement

CONTENT OF THE TEST

5. Items in section 4 may be performed in a helicopter FNPT or a helicopter FFS. Use of helicopter checklists, airmanship, control of helicopter by external visual reference, anti-icing procedures, and principles of threat and error management apply in all sections.

SECTION 1 — PRE-FLIGHT/POST-FLIGHT CHECKS AND PROCEDURES	
a	Helicopter knowledge (e.g. technical log, fuel, mass and balance, performance), flight planning, documentation, NOTAMS, weather
b	Pre-flight inspection/action, location of parts and purpose
c	Cockpit inspection, starting procedure
d	Communication and navigation equipment checks, selecting and setting frequencies
e	Pre-take-off procedure, R/T procedure, ATC liaison-compliance
f	Parking, shutdown and post-flight procedure

SECTION 2 — Hover manoeuvres, advanced handling and confined areas	
a	Take-off and landing (lift-off and touchdown)
b	Taxi, hover taxi
c	Stationary hover with head/cross/tail wind
d	Stationary hover turns, 360° left and right (spot turns)
e	Forward, sideways and backwards hover manoeuvring
f	Simulated engine failure from the hover
g	Quick stops into and downwind
h	Sloping ground/unprepared sites landings and take-offs
i	Take-offs (various profiles)
j	Crosswind, downwind take-off (if practicable)
k	Take-off at maximum take-off mass (actual or simulated)
l	Approaches (various profiles)
m	Limited power take-off and landing
n	Autorotations (FE to select two items from — Basic, range, low speed, and 360° turns)
o	Autorotative landing
p	Practice forced landing with power recovery
q	Power checks, reconnaissance technique, approach and departure technique
SECTION 3 — NAVIGATION — EN-ROUTE PROCEDURES	
a	Navigation and orientation at various altitudes/heights, map reading
b	Altitude/height, speed, heading control, observation of airspace, altimeter setting
c	Monitoring of flight progress, flight log, fuel usage, endurance, ETA, assessment of track error and re-establishment of correct track, instrument monitoring
d	Observation of weather conditions, diversion planning
e	Tracking, positioning (NDB and/or VOR), identification of facilities
f	ATC liaison and observance of regulations, etc.

SECTION 4 — FLIGHT PROCEDURES AND MANOEUVRES BY SOLE REFERENCE TO INSTRUMENTS	
a	Level flight, control of heading, altitude/height and speed
b	Rate 1 level turns onto specified headings, 180°to 360°left and right
c	Climbing and descending, including turns at rate 1 onto specified headings
d	Recovery from unusual attitudes
e	Turns with 30° bank, turning up to 90° left and right
SECTION 5 — Abnormal and Emergency procedures (simulated where appropriate)	
Note (1): Where the test is conducted on a multi-engine helicopter a simulated engine failure drill, including a single-engine approach and landing, shall be included in the test.	
Note (2): The FE shall select 4 items from the following:	
a	Engine malfunctions, including governor failure, carburettor/engine icing, oil system, as appropriate
b	Fuel system malfunction
c	Electrical system malfunction
d	Hydraulic system malfunction, including approach and landing without hydraulics, as applicable
e	Main rotor and/or anti-torque system malfunction (FFS or discussion only)
f	Fire drills, including smoke control and removal, as applicable
g	Other abnormal and emergency procedures as outlined in appropriate flight manual, including for multi-engine helicopters: Simulated engine failure at take-off: rejected take-off at or before TDP or safe forced landing at or before DPATO, shortly after TDP or DPATO. Landing with simulated engine failure: landing or go-around following engine failure before LDP or DPBL, following engine failure after LDP or safe forced landing after DPBL.

D. Content of the skill test for the issue of a CPL — Airships

1. The airship used for the skill test shall meet the requirements for training airships.

2. The area and route to be flown shall be chosen by the FE. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome and one destination shall be a controlled aerodrome. The skill test may be conducted in 2 flights. The total duration of the flight(s) shall be at least 60 minutes.

3. The applicant shall demonstrate the ability to:

(a) operate the airship within its limitations;

(b) complete all manoeuvres with smoothness and accuracy;

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge; and

(e) maintain control of the airship at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

Flight test tolerances

4. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the airship used.

Height

normal flight ±100 feet

simulated major emergency ±150 feet

Tracking on radio aids ±10°

Heading

normal flight ±10°

simulated major emergency ±15°

CONTENT OF THE TEST

5. Items in sections 5 and 6 may be performed in an Airship FNPT or an airship FFS. Use of airship checklists, airmanship, control of airship by external visual reference, anti-icing procedures, and principles of threat and error management apply in all sections.

SECTION 1 — PRE-FLIGHT OPERATIONS AND DEPARTURE	
a	Pre-flight, including: Flight planning, Documentation, Mass and Balance determination, Weather brief, NOTAMS
b	Airship inspection and servicing
c	Off-mast procedure, ground manoeuvring and take-off

d	Performance considerations and trim
e	Aerodrome and traffic pattern operations
f	Departure procedure, altimeter setting, collision avoidance (lookout)
g	ATC liaison – compliance, R/T procedures
SECTION 2 — GENERAL AIRWORK	
a	Control of the airship by external visual reference, including straight and level, climb, descent, lookout
b	Flight at pressure height
c	Turns
d	Steep descents and climbs
e	Flight by reference solely to instruments, including: (i) level flight, control of heading, altitude and airspeed (ii) climbing and descending turns (iii) recoveries from unusual attitudes (iv) limited panel instruments
f	ATC liaison – compliance, R/T procedures
SECTION 3 — EN-ROUTE PROCEDURES	
a	Control of airship by external visual reference, Range/Endurance considerations
b	Orientation, map reading
c	Altitude, speed, heading control, lookout
d	Altimeter setting, ATC liaison – compliance, R/T procedures

e	Monitoring of flight progress, flight log, fuel usage, assessment of track error and re-establishment of correct tracking
f	Observation of weather conditions, assessment of trends, diversion planning
g	Tracking, positioning (NDB or VOR), identification of facilities (instrument flight). Implementation of diversion plan to alternate aerodrome (visual flight)
SECTION 4 — APPROACH AND LANDING PROCEDURES	
a	Arrival procedures, altimeter setting, checks, lookout
b	ATC liaison – compliance, R/T procedures
c	Go-around action from low height
d	Normal landing
e	Short field landing
f	Approach and landing with idle power (single-engine only)
g	Landing without use of flaps
h	Post-flight actions
SECTION 5 — ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (at a safe altitude), fire drill
b	Equipment malfunctions
c	Forced landing (simulated)
d	ATC liaison – compliance, R/T procedures

e	Oral questions
SECTION 6 — RELEVANT CLASS OR TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in an FFS)
b	Approach and go-around with failed engine(s)
c	Approach and full stop landing with failed engine(s)
d	Malfunctions in the envelope pressure system
e	ATC liaison – compliance, R/T procedures, Airmanship
f	As determined by the FE — any relevant items of the class or type rating skill test to include, if applicable: (i) airship systems (ii) operation of envelope pressure system
g	Oral questions

Appendix 5 - Integrated MPL training course

GENERAL

1. The aim of the MPL integrated course is to train pilots to the level of proficiency necessary to enable them to operate as co-pilot of a multi- engine multi-pilot turbine-powered air transport aeroplane under VFR and IFR and to obtain an MPL.

2. Approval for an MPL training course shall only be given to an ATO that is part of a commercial air transport operator certificated in accordance with Part-ORO or having a specific arrangement with such an operator.

3. An applicant wishing to undertake an MPL integrated course shall complete all the instructional stages in one continuous course of training at an ATO. The training shall be competency based and conducted in a multi-crew operational environment.

4. Only *ab-initio* applicants shall be admitted to the course.

5. The course shall comprise:

(a) theoretical knowledge instruction to the ATPL(A) knowledge level;

(b) visual and instrument flying training;

(c) training in MCC for the operation of multi-pilot aeroplanes; and

(d) type rating training.

6. An applicant failing or unable to complete the entire MPL course may apply to the competent authority for the theoretical knowledge examination and skill test for a licence with lower privileges and an IR, if the applicable requirements are met.

THEORETICAL KNOWLEDGE

7. An approved MPL theoretical knowledge course shall comprise at least 750 hours of instruction for the ATPL(A) knowledge level, as well as the hours required for theoretical knowledge instruction for the relevant type rating, in accordance with Subpart H.

FLYING TRAINING

8. The flying training shall comprise a total of at least 240 hours, composed of hours as PF and PNF, in actual and simulated flight, and covering the following 4 phases of training:

(a) Phase 1 — Core flying skills

Specific basic single-pilot training in an aeroplane.

(b) Phase 2 — Basic

Introduction of multi-crew operations and instrument flight.

(c) Phase 3 — Intermediate

Application of multi-crew operations to a multi-engine turbine aeroplane certified as a high performance aeroplane in accordance with Part-21.

(d) Phase 4 — Advanced

Type rating training within an airline oriented environment.

Flight experience in actual flight shall include all the experience requirements of Subpart H, upset recovery training, night flying, flight solely by reference to instruments and the experience required to achieve the relevant airmanship.

MCC requirements shall be incorporated into the relevant phases above.

Training in asymmetric flight shall be given either in an aeroplane or an FFS.

9. Each phase of training in the flight instruction syllabus shall be composed of both instruction in the underpinning knowledge and in practical training segments.

10. The training course shall include a continuous evaluation process of the training syllabus and a continuous assessment of the students following the syllabus. Evaluation shall ensure that:

(a) the competencies and related assessment are relevant to the task of a co- pilot of a multi-pilot aeroplane; and

(b) the students acquire the necessary competencies in a progressive and satisfactory manner.

11. The training course shall include at least 12 take-offs and landings to ensure competency. These take-offs and landings shall be performed under the supervision of an instructor in an aeroplane for which the type rating shall be issued.

ASSESSMENT LEVEL

12. The applicant for the MPL shall have demonstrated performance in all 9 competency units specified in paragraph 13 below, at the advanced level of competency required to operate and interact as a co-pilot in a turbine-powered multi-pilot aeroplane, under visual and instrument conditions. Assessment shall confirm that control of the aeroplane or situation is maintained at all times, to ensure the successful outcome of a procedure or manoeuvre. The applicant shall consistently demonstrate the knowledge, skills and attitudes required for the safe operation of the applicable aeroplane type, in accordance with the MPL performance criteria.

COMPETENCY UNITS

13. The applicant shall demonstrate competency in the following 9 competency units:

(1) apply human performance principles, including principles of threat and error management;

(2) perform aeroplane ground operations;

(3) perform take-off;

(4) perform climb;

(5) perform cruise;

(6) perform descent;

(7) perform approach;

(8) perform landing; and

(9) perform after landing and aeroplane post-flight operations.

SIMULATED FLIGHT

14. Minimum requirements for FSTDs:

(a) Phase 1 — Core flying skills

E-training and part tasking devices approved by the competent authority that have the following characteristics:

— involve accessories beyond those normally associated with desktop computers, such as functional replicas of a throttle quadrant, a side- stick controller, or an FMS keypad, and

— involve psychomotor activity with appropriate application of force and timing of responses.

(b) Phase 2 — Basic

An FNPT II MCC that represents a generic multi-engine turbine-powered aeroplane.

(c) Phase 3 — Intermediate

An FSTD that represents a multi-engine turbine-powered aeroplane required to be operated with a co-pilot and qualified to an equivalent standard to level B, additionally including:

— a daylight/twilight/night visual system continuous cross-cockpit minimum collimated visual field of view providing each pilot with 180° horizontal and 40° vertical field of view, and

— ATC environment simulation.

(d) Phase 4 — Advanced

An FFS which is fully equivalent to level D or level C with an enhanced daylight visual system, including ATC environment simulation.

GM1 to Appendix 5 Integrated MPL training course

GENERAL

(a) In broad terms, the MPL holder is expected to be able to complete the airline operators' conversion course with a high probability of success and within the time frame normally allowed for this phase. The standard is equivalent to what is currently expected from graduates of the ATP(A) integrated course who have completed type rating training.

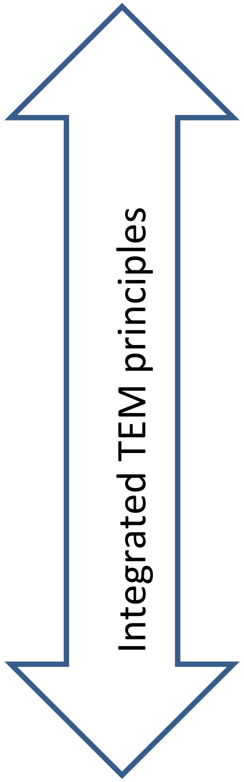
(b) The general approach is to use the existing ATP(A) integrated training course as a reference and to implement progressively the MPL integrated training course and specifically the transfer from actual flight to simulated flight.

(c) This transfer should be organised in a way that is similar to the approach used for ETOPS. Successive evolutions of the training syllabus introduce progressively a higher level of simulated flight and a reduction of actual flight. Change from one version to the next should only take place after enough experience has been gained and once its results, including those of airline operator conversion courses, have been analysed and taken into account.

MPL TRAINING SCHEME

(d) The following scheme should be applied:

MPL Training Scheme
Minimum 240 hours of training, including “Pilot Flying” (PF) and “Pilot Non Flying” (PNF)



Phases of training	**Training items**	**Flight and simulated flight training media - Minimum level requirement -**		**Ground training media**
Phase 4 – advanced Type rating training within an airline oriented environment	• CRM • Landing training • All weather • LOFT • Abnormal procedures • Normal procedures	Aeroplane: ME Multi-crew certified FSTD FS level D or C + ATC simulation	12 take-offs and landings as PF PF / PNF	
Phase 3 – intermediate Application of multi-crew operations in a high performance ME turbine aeroplane	• CRM • LOFT • Abnormal procedures • Normal procedures • Multi-crew • Instrument flight	FSTD: *representing an ME turbine powered aeroplane to be operated with a co-pilot and qualified to an equivalent standard to level B + ATC simulation*	PF / PNF	• CBT • E-learning • Part task trainer • Class room
Phase 2 – basic Introduction of multi-crew operations and instrument flight	• CRM • PF / PNF complement • IFR cross-country • Instrument flight	Aeroplane: SE or ME FSTD: FNPT II + MCC	PF / PNF	
Phase 1 – core flying skills	• CRM • VFR Cross-country • Solo flight	Aeroplane: SE or ME		

	Specific basic SP training	• Basic Instrument flight • Principles of flight • Cockpit procedures • Upset recovery • Night flight	FSTD: FNPT I / BITD	PF	

THEORETICAL KNOWLEDGE INSTRUCTION

(e) The 750 hours of theoretical knowledge instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

COMPETENCY UNITS, COMPETENCY ELEMENTS AND PERFORMANCE CRITERIA

(f) Apply human performance principles, including principles of threat and error management:

(1) cooperation;

(2) leadership and managerial skills;

(3) situation awareness;

(4) decision making.

These behaviour categories are intended to help in the effective utilisation of all available resources to achieve safe and efficient operations.

These behaviour categories may be adapted and extended to incorporate issues like communication and use of automation if it is considered to be relevant to the development of the curriculum.

(g) Perform Aircraft Ground and Pre-Flight Operations

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

			Duty	Observation and assessment Satisfactory (S) Unsatisfactory (U)
(2)		perform dispatch duties:		(S) or (U)
	(i)	verifies technical condition of the a/c, including adequate use of MEL;	PF/PNF	
	(ii)	checks technical bulletins and notices;	PF/PNF	
	(iii)	determines operational environment and pertinent	PF/PNF	
	(iv)	determines impact of weather on aircraft performance;	PF/PNF	
	(v)	applies flight planning and load procedures;	PF/PNF	

	(vi)	determines fuel requirement;	PF/PNF	
(3)		provide flight crew and cabin crew briefings;		(S) or (U)
	(i)	briefed flight crew in all relevant matters;	PF	
	(ii)	briefed cabin crew in all relevant matters.	PF	
(4)		perform pre-flight checks and cockpit preparation:		(S) or (U)
	(i)	ensures the airworthiness of the aircraft;	PF	
	(ii)	performs the cockpit preparation and briefings;	PF/PNF	
	(iii)	performs FMS initialisation, data insertion and confirmation;	PF/PNF	
	(iv)	optimises and checks take-off performance and take-off data	PF/PNF	
(5)		perform engine start:		(S) or (U)
	(i)	asks for, receives acknowledges and checks ATC clearance;	PNF	
	(ii)	performs engine start procedure;	PF/PNF	
	(iii)	uses standard communication procedures with ground crew and ATC.	PF/PNF	
(6)		perform taxi out:		(S) or (U)
	(i)	receives, checks and adheres to taxi clearance;	PNF	
	(ii)	taxis the aircraft, including use of exterior lighting;	PF	
	(iii)	complies to taxi clearance;	PF/PNF	
	(iv)	maintains look-out for conflicting traffic and obstacles;	PF/PNF	
	(v)	operates thrust, brakes and steering;	PF	
	(vi)	conducts relevant briefings;	PF	
	(vii)	uses standard communication procedures with crew and ATC;	PNF	
	(viii)	completes standard operating procedures and checklists;	PF/PNF	
	(ix)	updates and confirms FMS data;	PF/PNF	

	(x)	manages changes in performance and departure route;	PF/PNF	
	(xi)	completes de or anti-ice procedures.	PF/PNF	
(7)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(8)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF/PNF	
(h)		Perform take-off		
		List of competency elements and performance criteria:		
(1)		demonstrate attitudes and behaviours appropriate to the safe conduct of including recognising flight, and managing potential		
(2)		perform pre-take-off and pre-departure preparation:		(S) or (U)
	(i)	checks and acknowledges line up clearance;	PF/PNF	
	(ii)	checks correct runway selection ;	PF/PNF	
	(iii)	confirms validity of performance data;	PF/PNF	
	(iv)	checks approach sector and runway are clear;	PF/PNF	
	(v)	confirms all checklists and take-off preparations completed;	PF/PNF	
	(vi)	lines up the aircraft on centreline without losing distance;	PF	
	(vii)	checks weather on departure sector;	PF/PNF	
	(viii)	checks runway status and wind.	PF/PNF	

(3)		perform take-off roll:		(S) or (U)
	(i)	applies take-off thrust;	PF	
	(ii)	checks engine parameters;	PNF	
	(iii)	checks air speed indicators;	PF/PNF	
	(iv)	stays on runway centreline.	PF	
(4)		perform transition to instrument flight rules:		(S) or (U)
	(i)	applies v_1 procedures;	PF / PNF	
	(ii)	rotates at v_r to initial pitch attitude;	PF	
	(iii)	establishes initial wings level attitude;	PF	
	(iv)	retracts landing gear;	PNF	
	(v)	maintains climb out speed.	PF	
(5)		perform initial climb to flap retraction altitude:		(S) or (U)
	(i)	sets climb power;	PF	
	(ii)	adjusts attitude for acceleration;	PF	
	(iii)	selects flaps according flap speed schedule;	PF/PNF	
	(iv)	observes speed restrictions;	PF	
	(v)	completes relevant checklists.	PF/PNF	
(6)		perform rejected take-off:		(S) or (U)
	(i)	recognises the requirement to abort the take-off;	PF	
	(ii)	applies the rejected take-off procedure;	PF	
	(iii)	assesses the need to evacuate the aircraft.	PF/PNF	
(7)		perform navigation:		(S) or (U)
	(i)	complies to departure clearance;	PF	

	(ii)	complies with published departure procedures, for example speeds;	PF	
	(iii)	monitors navigation accuracy;	PF/PNF	
	(iv)	communicates and coordinates with ATC.	PNF	
(8)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(i)		Perform climb		
		List of competency elements and performance criteria:		
(1)		demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;		
(2)		perform SID or en-route navigation:		(S) or (U)
	(i)	complies with departure clearance and procedures;	PF	
	(ii)	demonstrates terrain awareness;	PF/PNF	
	(iii)	monitors navigation accuracy;	PF/PNF	
	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC;	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	selects appropriate level of automation;	PF	
	(viii)	complies with altimeter setting procedures.	PF/PNF	
(3)		complete climb procedures and checklists:		(S) or (U)
	(i)	performs the after take-off items;	PF/PNF	
	(ii)	confirms and checks according checklists.	PF/PNF	
(4)		modify climb speeds, rate of climb and cruise altitude:		(S) or (U)

	(i)	recognises the need to change speed, rate	PF	
	(ii)	selects and maintains the appropriate climb speed or rate of climb;	PF	
	(iii)	selects optimum cruise flight level.	PF/PNF	
(5)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PF/PNF	
(6)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(7)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF	

(j) Perform cruise

List of competency elements and performance criteria.

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		monitor navigation accuracy:		(S) or (U)
	(i)	demonstrates adequate area	PF/PNF	
	(ii)	demonstrates adequate route	PF/PNF	
	(iii)	navigates according to flight plan and clearance;	PF	
	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	uses all means of automation.	PF	
(3)		monitor flight progress:		(S) or (U)

	(i)	selects optimum speed;	PF	
	(ii)	selects optimum cruise flight level;	PF	
	(iii)	monitors and controls fuel status;	PF/PNF	
	(iv)	recognises the need for a possible diversion;	PF/PNF	
	(v)	creates a diversion contingency plan if required.	PF/PNF	
(4)		perform descent and approach planning:		(S) or (U)
	(i)	checks weather of destination and alternate airport;	PF/PNF	
	(ii)	checks runway in use and approach procedure;	PF/PNF	
	(iii)	sets the FMS accordingly;	PNF	
	(iv)	checks landing weight and landing distance required;	PNF	
	(v)	checks MEA, MGA and MSA;	PF/PNF	
	(vi)	identifies top of descent point.	PF	
(5)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PNF	
(6)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(7)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF	
(k)	Perform descent			

List of competency elements and performance criteria:

(1) Demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		initiate and manage descent:		(S) or (U)
	(i)	starts descent according to ATC clearance or optimum descent point;	PF	
	(ii)	selects optimum speed and descent rate;	PF	
	(iii)	adjusts speed to existing environmental conditions;	PF	
	(iv)	recognises the need to adjust the descent path;	PF	
	(v)	adjusts the flight path as required;	PF	
	(vi)	utilises all means of FMS descent information.	PF	
(3)		monitor and perform en route and descent navigation:		(S) or (U)
	(i)	complies with arrival clearance and procedures;	PF	
	(ii)	demonstrates terrain awareness;	PF/PNF	
	(iii)	monitors navigation accuracy;	PF/PNF	
	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC;	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	selects appropriate level or mode of automation;	PF	
	(viii)	complies with altimeter setting procedures.	PF/PNF	
(4)		re-planning and update of approach briefing:		(S) or (U)
	(i)	re-checks destination weather and runway in use;	PNF	
	(ii)	briefs or re-briefs about instrument approach and landing as required;	PF	
	(iii)	reprograms the FMS as required;	PNF	
	(iv)	re-checks fuel status.	PF/PNF	
(5)		perform holding:		(S) or (U)

	(i)	identifies holding requirement;	PF/PNF	
	(ii)	programs FMS for holding pattern;	PNF	
	(iii)	enters and monitors holding pattern;	PF	
	(iv)	assesses fuel requirements and determines max holding time;	PF/PNF	
	(v)	reviews the need for a diversion;	PF/PNF	
	(vi)	initiates diversion.	PF	
(6)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PF/PNF	
(7)		manage abnormal and emergency situations:		
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(8)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate;	PF	

(l) Perform approach

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		perform approach in general:		(S) or (U)
	(i)	executes approach according to procedures and situation;	PF	
	(ii)	selects appropriate level or mode of automation;	PF	
	(iii)	selects optimum approach path;	PF	

	(iv)	operates controls smooth and coordinated;	PF	
	(v)	performs speed reduction and flap extension;	PF/PNF	
	(vi)	performs relevant checklists;	PF/PNF	
	(vii)	initiates final descent;	PF	
	(viii)	achieves stabilised approach criteria;	PF	
	(ix)	ensures adherence to minima;	PF/PNF	
	(x)	initiates go-around if required;	PF	
	(xi)	masters transition to visual segment.	PF	
(3)		perform precision approach:		(S) or (U)
	(i)	performs ILS approach;	PF	
	(ii)	performs MLS approach.	PF	
(4)		perform non-precision approach:		(S) or (U)
	(i)	performs VOR approach;	PF	
	(ii)	performs NDB approach;	PF	
	(iii)	performs SRE approach;	PF	
	(iv)	performs GNSS approach;	PF	
	(v)	performs ILS loc approach;	PF	
	(vi)	performs ILS back beam approach.	PF	
(5)		perform approach with visual reference to ground:		(S) or (U)
	(i)	performs standard visual approach;	PF	
	(ii)	performs circling approach.	PF	
(6)		monitor the flight progress:		(S) or (U)
	(i)	insures navigation accuracy;	PF/PNF	
	(ii)	communicates with ATC and crew members;	PNF	

	(iii)	monitors fuel status.	PF/PNF	
(7)		perform systems operations and procedures:		
	(i)	monitors operation of all systems;	PF	
	(ii)	operates systems as required.	PF	
(8)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(9)		perform missed approach and go-around:		(S) or (U)
	(i)	initiates go-around procedure;	PF	
	(ii)	navigates according to missed approach procedure;	PF	
	(iii)	completes the relevant checklists;	PF/PNF	
	(iv)	initiates approach or diversion after the go-around;	PF	
	(v)	communicates with ATC and crew members.	PNF	
(10)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate;	PF	
	(iv)	initiates go-around procedure.	PF	

(m) Perform landing

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		land the aircraft;		(S) or (U)
	(i)	maintains a stabilised approach path during visual segment;	PF	

	(ii)	recognises and acts on changing conditions for windshift or wind	PF	
	(iii)	initiates flare;	PF	
	(iv)	controls thrust;	PF	
	(v)	achieves touchdown in touchdown zone on centreline;	PF	
	(vi)	lowers nose wheel;	PF	
	(vii)	maintains centreline;	PF	
	(viii)	performs after-touchdown procedures;	PF	
	(ix)	makes use of appropriate braking and reverse thrust;	PF	
	(x)	vacates runway with taxi speed.	PF	
(3)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF	
	(ii)	operates systems as required.	PF	
(4)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	

(n) Perform after landing and post flight operations

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		perform taxiing and parking:		(S) or (U)
	(i)	receives, checks and adheres to taxi clearance;	PNF	
	(ii)	taxies the aircraft including use of exterior lighting;	PF	
	(iii)	controls taxi speed;	PF/PNF	
	(iv)	maintains centreline;	PF	

	(v)	maintains look-out for conflicting traffic and obstacles;	PF	
	(vi)	identifies parking position;	PF/PNF	
	(vii)	complies with marshalling or stand guidance;	PF/PNF	
	(viii)	applies parking and engine shut down procedures;	PF	
	(ix)	completes with relevant checklists.	PF/PNF	
(3)		perform aircraft post-flight operations:		(S) or (U)
	(i)	communicates to ground personnel and crew;	PF	
	(ii)	completes all required flight documentation;	PF/PNF	
	(iii)	ensures securing of the aircraft;	PF	
	(iv)	conducts the debriefings.	PF	
(4)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PF/PNF	
(5)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(6)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF	

PRINCIPLES OF THREAT AND ERROR MANAGEMENT

(o) One model that explains the principles of threat and error management is the TEM model.

(1) The components of the TEM model:

There are three basic components in the TEM model, from the perspective of flight crews: threats, errors and undesired aircraft states. The model proposes that threats and errors are part of everyday aviation operations that must be managed by flight crews, since both threats and errors carry the potential to generate undesired aircraft states. Flight crews must also manage undesired aircraft states, since they carry the potential for unsafe outcomes. Undesired state management is an essential component of the TEM model, as important as threat and error management. Undesired aircraft state management largely represents the last opportunity to avoid an unsafe outcome and thus maintain safety margins in flight operations.

(2) Threats:

(i) Threats are defined as events or errors that occur beyond the influence of the flight crew, increase operational complexity, and which must be managed to maintain the margins of safety. During typical flight operations, flight crews have to manage various contextual complexities. Such complexities would include, for example, dealing with adverse meteorological conditions, airports surrounded by high mountains, congested airspace, aircraft malfunctions, errors committed by other people outside of the cockpit, such as air traffic controllers, flight attendants or maintenance workers, and so forth. The TEM model considers these complexities as threats because they all have the potential to negatively affect flight operations by reducing margins of safety;

(ii) Some threats can be anticipated, since they are expected or known to the flight crew. For example, flight crews can anticipate the consequences of a thunderstorm by briefing their response in advance, or prepare for a congested airport by making sure they keep a watchful eye on other aircraft as they execute the approach;

(iii) Some threats can occur unexpectedly, such as an in-flight aircraft malfunction that happens suddenly and without warning. In this case, flight crews must apply skills and knowledge acquired through training and operational experience;

(iv) Lastly, some threats may not be directly obvious to, or observable by, flight crews immersed in the operational context, and may need to be uncovered by safety analysis. These are considered latent threats. Examples of latent threats include equipment design issues, optical illusions, or shortened turn-around schedules;

(v) Regardless of whether threats are expected, unexpected, or latent, one measure of the effectiveness of a flight crew's ability to manage threats is whether threats are detected with the necessary anticipation to enable the flight crew to respond to them through deployment of appropriate countermeasures;

(vi) Threat management is a building block to error management and undesired aircraft state management. Although the threat-error linkage is not necessarily straightforward, and although it may not be always possible to establish a linear relationship, or one-to-one mapping between threats, errors and undesired states, archival data demonstrates that mismanaged threats are normally linked to flight crew errors, which in turn are often linked to undesired aircraft states. Threat management provides the most proactive option to maintain margins of safety in flight operations, by voiding safety-compromising situations at their roots. As threat managers, flight crews are the last line of defence to keep threats from impacting flight operations;

(vii) Table 1 presents examples of threats, grouped under two basic categories derived from the TEM Model. Environmental threats occur due to the environment in which flight operations take place. Some environmental threats can be planned for and some will arise spontaneously, but they all have to be managed by flight crews in real time. Organisational threats, on the other hand, can be controlled (for example removed or, at least, minimised) at source by aviation organisations. Organisational threats are usually latent in nature. Flight crews still remain the last line of defence, but there are earlier opportunities for these threats to be mitigated by aviation organisations themselves.

Environmental threats	Organisational threats
(A) weather: thunderstorms, turbulence, icing, wind shear, cross or tailwind, very low or high temperatures; (B) ATC: traffic congestion, ACAS RA/TA, ATC command, ATC error, ATC language difficulty, ATC non-standard phraseology, ATC runway change, ATIS communication or units of measurement (QFE/meters); (C) airport: contaminated or short runway; contaminated taxiway, lack of, confusing, faded signage, markings, birds, aids unserviceable, complex surface navigation procedures or airport constructions; (D) terrain: high ground, slope, lack of references or 'black hole'; (E) other: similar call-signs.	(A) operational pressure: delays, late arrivals or equipment changes; (B) aircraft: aircraft malfunction, automation event or anomaly, MEL/CDL; (C) cabin: flight attendant error, cabin event distraction, interruption, cabin door security; (D) maintenance: maintenance event or error; (E) ground: ground-handling event, de-icing or ground crew error; (F) dispatch: dispatch paperwork event or error; (G) documentation: manual error or chart error; (H) other: crew scheduling event.

Table 1. Examples of threats (list is not exhaustive)

(3) Errors:

(i) Errors are defined actions or inactions by the flight crew that lead to deviations from organisational or flight crew intentions or expectations. Unmanaged or mismanaged errors frequently lead to undesired aircraft states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of adverse events;

(ii) Errors can be spontaneous (for example without direct linkage to specific, obvious threats), linked to threats, or part of an error chain. Examples of errors would include the inability to maintain stabilised approach parameters, executing a wrong automation mode, failing to give a required callout, or misinterpreting an ATC clearance;

(iii) Regardless of the type of error, an error's effect on safety depends on whether the flight crew detects and responds to the error before it leads to an undesired aircraft state and to a potential unsafe outcome. This is why one of the objectives of TEM is to understand error management (for example detection and response), rather than to solely focus on error causality (for example causation and commission). From the safety perspective, operational errors that are timely detected and promptly responded to (for example properly managed), errors that do not lead to undesired aircraft states, do not reduce margins of safety in flight operations, and thus become operationally inconsequential. In addition to its safety value, proper error management represents an example of successful human performance, presenting both learning and training value;

(iv) Capturing how errors are managed is then as important, if not more, as capturing the prevalence of different types of error. It is of interest to capture if and when errors are detected and by whom, the response(s) upon detecting errors, and the outcome of errors. Some errors are quickly detected and resolved, thus becoming operationally inconsequential, while others go undetected or are mismanaged. A mismanaged error is defined as an error that is linked to or induces an additional error or undesired aircraft state;

(v) Table 2 presents examples of errors, grouped under three basic categories derived from the TEM model. In the TEM concept, errors have to be 'observable' and therefore, the TEM model uses the 'primary interaction' as the point of reference for defining the error categories;

(vi) The TEM model classifies errors based upon the primary interaction of the pilot or flight crew at the moment the error is committed. Thus, in order to be classified as aircraft handling error, the pilot or flight crew must be interacting with the aircraft (for example through its controls, automation or systems). In order to be classified as procedural error, the pilot or flight crew must be interacting with a procedure (for example checklists; SOPs; etc.). In order to be classified as communication error, the pilot or flight crew must be interacting with people (ATC, ground crew, other crewmembers, etc.);

(vii) Aircraft handling errors, procedural errors and communication errors may be unintentional or involve intentional non-compliance. Similarly, proficiency considerations (for example skill or knowledge deficiencies, training system deficiencies) may underlie all three categories of error. In order to keep the approach simple and avoid confusion, the TEM model does not consider intentional non-compliance and proficiency as separate categories of error, but rather as sub-sets of the three major categories of error.

Aircraft handling errors	(A) manual handling, flight controls: vertical, lateral or speed deviations, incorrect flaps or speed brakes, thrust reverser or power settings; (B) automation: incorrect altitude, speed, heading, auto throttle settings, incorrect mode executed or incorrect entries; (C) systems, radio, instruments: incorrect packs, incorrect anti-icing, incorrect altimeter, incorrect fuel switches settings, incorrect speed bug or incorrect radio frequency dialled; (D) ground navigation: attempting to turn down wrong taxiway or runway, taxi too fast, failure to hold short or missed taxiway or runway.
Procedural errors	(A) SOPs: failure to cross-verify automation inputs; (B) checklists: wrong challenge and response; items missed, checklist performed late or at the wrong time; (C) callouts: omitted or incorrect callouts;

	(D) briefings: omitted briefings; items missed; (E) documentation: wrong weight and balance, fuel information, ATIS, or clearance information recorded, misinterpreted items on paperwork; incorrect logbook entries or incorrect application of MEL procedures.
Communication errors	(A) crew to external: missed calls, misinterpretations of instructions, incorrect read-back, wrong clearance, taxiway, gate or runway communicated; (B) pilot to pilot: within crew miscommunication or mis-interpretation.

Table 2. Examples of errors (list is not exhaustive)

(4) Undesired aircraft states:

(i) Undesired aircraft states are flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety. Undesired aircraft states that result from ineffective threat or error management may lead to compromising situations and reduce margins of safety in flight operations. Often considered at the cusp of becoming an incident or accident, undesired aircraft states must be managed by flight crews;

(ii) Examples of undesired aircraft states would include lining up for the incorrect runway during approach to landing, exceeding ATC speed restrictions during an approach, or landing long on a short runway requiring maximum braking. Events such as equipment malfunctions or ATC controller errors can also reduce margins of safety in flight operations, but these would be considered threats;

(iii) Undesired states can be managed effectively, restoring margins of safety, or flight crew response(s) can induce an additional error, incident, or accident;

(iv) Table 3 presents examples of undesired aircraft states, grouped under three basic categories derived from the TEM model;

Aircraft handling	(A) aircraft control (attitude); (B) vertical, lateral or speed deviations; (C) unnecessary weather penetration; (D) unauthorised airspace penetration; (E) operation outside aircraft limitations; (F) unstable approach; (G) continued landing after unstable approach;

	(H) long, floated, firm or off-centreline landing.
Ground navigation	(A) proceeding towards wrong taxiway or runway; (B) Wrong taxiway, ramp, gate or hold spot.
Incorrect aircraft configurations	(A) incorrect systems configuration; (B) incorrect flight controls configuration; (C) incorrect automation configuration; (D) incorrect engine configuration; (E) incorrect weight and balance configuration.

Table 3. Examples of undesired aircraft states (list is not exhaustive)

(v) An important learning and training point for flight crews is the timely switching from error management to undesired aircraft state management. An example would be as follows: a flight crew selects a wrong approach in the FMC. The flight crew subsequently identifies the error during a cross-check prior to the FAF. However, instead of using a basic mode (for example heading) or manually flying the desired track, both flight crew members become involved in attempting to reprogram the correct approach prior to reaching the FAF. As a result, the aircraft 'stitches' through the localiser, descends late, and goes into an unstable approach. This would be an example of the flight crew getting 'locked in' to error management, rather than switching to undesired aircraft state management. The use of the TEM model assists in educating flight crews that, when the aircraft is in an undesired state, the basic task of the flight crew is undesired aircraft state management instead of error management. It also illustrates how easy it is to get locked in to the error management phase;

(vi) Also from a learning and training perspective, it is important to establish a clear differentiation between undesired aircraft states and outcomes. Undesired aircraft states are transitional states between a normal operational state (for example a stabilised approach) and an outcome. Outcomes, on the other hand, are end states, most notably, reportable occurrences (for example incidents and accidents). An example would be as follows: a stabilised approach (normal operational state) turns into an unstabilised approach (undesired aircraft state) that results in a runway excursion (outcome);

(vii) The training and remedial implications of this differentiation are of significance. While at the undesired aircraft state stage, the flight crew has the possibility, through appropriate TEM, of recovering the situation, returning to a normal operational state, thus restoring margins of safety. Once the undesired aircraft state becomes an outcome, recovery of the situation, return to a normal operational state, and restoration of margins of safety is not possible.

(5) Countermeasures:

(i) Flight crews must, as part of the normal discharge of their operational duties, employ countermeasures to keep threats, errors and undesired aircraft states from reducing margins of safety in flight operations. Examples of countermeasures would include checklists, briefings, call-outs and SOPs, as well as personal strategies and tactics. Flight crews dedicate significant amounts of time and energies to the application of countermeasures to ensure margins of safety during flight operations. Empirical observations during training and checking suggest that as much as 70 % of flight crew activities may be countermeasures-related activities.

(ii) All countermeasures are necessarily flight crew actions. However, some countermeasures to threats, errors and undesired aircraft states that flight crews employ build upon 'hard' resources provided by the aviation system. These resources are already in place in the system before flight crews report for duty, and are therefore considered as systemic-based countermeasures. The following would be examples of 'hard' resources that flight crews employ as systemic-based countermeasures:

(A) ACAS;

(B) TAWS;

(C) SOPs;

(D) checklists;

(E) briefings;

(F) training;

(G) etc.

(iii) Other countermeasures are more directly related to the human contribution to the safety of flight operations. These are personal strategies and tactics, individual and team countermeasures that typically include canvassed skills, knowledge and attitudes developed by human performance training, most notably, by CRM training. There are basically three categories of individual and team countermeasures:

(A) planning countermeasures: essential for managing anticipated and unexpected threats;

(B) execution countermeasures: essential for error detection and error response;

(C) review countermeasures: essential for managing the changing conditions of a flight.

(iv) Enhanced TEM is the product of the combined use of systemic-based and individual and team countermeasures. Table 4 presents detailed examples of individual and team countermeasures. Further guidance on countermeasures can be found in the sample assessment guides for terminal training objectives (PANS-TRG, Chapter 3, Attachment B) as well as in the ICAO manual, Line Operations Safety Audit (LOSA) (Doc 9803).

Planning countermeasures		
SOP briefing	The required briefing was interactive and operationally thorough	(A) Concise, not rushed, and met SOP requirements; (B) Bottom lines were established
Plans stated	Operational plans and decisions were communicated and acknowledged	Shared understanding about plans: 'Everybody on the same page'
Workload assignment	Roles and responsibilities were defined for normal and non-normal situations	Workload assignments were communicated and acknowledged
Contingency management	Crew members developed effective strategies to manage threats to safety	(A) Threats and their consequences were anticipated; (B) Used all available resources to manage threats
Execution countermeasures		
Monitor and cross-check	Crew members actively monitored and cross-checked systems and other crew members	Aircraft position, settings, and crew actions were verified
Workload management	Operational tasks were prioritised and properly managed to handle primary flight duties	(A) Avoided task fixation; (B) Did not allow work overload
Automation management	Automation was properly managed to balance situational and workload requirements	(A) Automation setup was briefed to other members (B) Effective recovery techniques from automation anomalies
Review countermeasures		
Evaluation and modification of plans	Existing plans were reviewed and modified when necessary	Crew decisions and actions were openly analysed to make sure the existing plan was the best plan

Inquiry	Crew members asked questions to investigate and/or clarify current plans of action	Crew members not afraid to express a lack of knowledge: 'Nothing taken for granted' attitude
Assertiveness	Crew members stated critical information or solutions with appropriate persistence	Crew members spoke up without hesitation

Appendix 6 - Modular training courses for the IR

A. IR(A) — Modular flying training course

GENERAL

1. The aim of the IR(A) modular flying training course is to train pilots to the level of proficiency necessary to operate aeroplanes under IFR and in IMC. The course consists of two modules, which may be taken separately or combined:

(a) Basic Instrument Flight Module

This comprises 10 hours of instrument time under instruction, of which up to 5 hours can be instrument ground time in a BITD, FNPT I or II, or an FFS. Upon completion of the Basic Instrument Flight Module, the candidate shall be issued a Course Completion Certificate.

(b) Procedural Instrument Flight Module

This comprises the remainder of the training syllabus for the IR(A), 40 hours single-engine or 45 hours multi-engine instrument time under instruction, and the theoretical knowledge course for the IR(A).

2. An applicant for a modular IR(A) course shall be the holder of a PPL(A) or a CPL(A). An applicant for the Procedural Instrument Flight Module, who does not hold a CPL(A), shall be holder of a Course Completion Certificate for the Basic Instrument

Flight Module.

The ATO shall ensure that the applicant for a multi-engine IR(A) course who has not held a multi-engine aeroplane class or type rating has received the multi-engine training specified in Subpart H prior to commencing the flight training for the IR(A) course.

3. An applicant wishing to undertake the Procedural Instrument Flight Module of a modular IR(A) course shall be required to complete all the instructional stages in one continuous approved course of training. Prior to commencing the Procedural Instrument Flight Module, the ATO shall ensure the competence of the applicant in basic instrument flying skills. Refresher training shall be given as required.

4. The course of theoretical instruction shall be completed within 18 months. The Procedural Instrument Flight Module and the skill test shall be completed within the period of validity of the pass in theoretical examinations.

5. The course shall comprise:

(a) theoretical knowledge instruction to the IR knowledge level;

(b) instrument flight instruction.

THEORETICAL KNOWLEDGE

6. An approved modular IR(A) course shall comprise at least 150 hours of theoretical knowledge instruction.

FLYING TRAINING

7. A single-engine IR(A) course shall comprise at least 50 hours instrument time under instruction of which up to 20 hours may be instrument ground time in an FNPT I, or up to 35 hours in an FFS or FNPT II. A maximum of 10 hours of FNPT II or an FFS instrument ground time may be conducted in an FNPT I.

8. A multi-engine IR(A) course shall comprise at least 55 hours instrument time under instruction, of which up to 25 hours may be instrument ground time in an FNPT I, or up to 40 hours in an FFS or FNPT II. A maximum of 10 hours of FNPT II or an FFS instrument ground time may be conducted in an FNPT I. The remaining instrument flight instruction shall include at least 15 hours in multi-engine aeroplanes.

9. The holder of a single-engine IR(A) who also holds a multi-engine class or type rating wishing to obtain a multi-engine IR(A) for the first time shall complete a course at an ATO comprising at least 5 hours instruction in instrument flying in multi-engine aeroplanes, of which 3 hours may be in an FFS or FNPT II.

10.1 The holder of a CPL(A) or of a Course Completion Certificate for the Basic Instrument Flight Module may have the total amount of training required in paragraphs 7 or 8 above reduced by 10 hours.

10.2 The holder of an IR(H) may have the total amount of training required in paragraphs 7 or 8 above reduced to 10 hours.

10.3 The total instrument flight instruction in aeroplane shall comply with paragraph 7 or 8, as appropriate.

11. The flying exercises up to the IR(A) skill test shall comprise:

(a) Basic Instrument Flight Module: Procedure and manoeuvre for basic instrument flight covering at least:

basic instrument flight without external visual cues:

— horizontal flight,

— climbing,

— descent,

— turns in level flight, climbing, descent; instrument pattern; steep turn; radio navigation; recovery from unusual attitudes; limited panel; recognition and recovery from incipient and full stalls;

(b) Procedural Instrument Flight Module:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate air traffic services documents in the preparation of an IFR flight plan;

(ii) procedure and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

— transition from visual to instrument flight on take-off,

— standard instrument departures and arrivals,

— en-route IFR procedures,

— holding procedures,

— instrument approaches to specified minima,

— missed approach procedures,

— landings from instrument approaches, including circling;

(iii) in-flight manoeuvres and particular flight characteristics;

(iv) if required, operation of a multi-engine aeroplane in the above exercises, including operation of the aeroplane solely by reference to instruments with one engine simulated inoperative and engine shutdown and restart (the latter exercise to be carried out at a safe altitude unless carried out in an FFS or FNPT II).

Aa. IR(A) — Competency-based modular flying training course

GENERAL

1. The aim of the competency-based modular flying training course is to train PPL or CPL holders for the instrument rating, taking into account prior instrument flight instruction and experience. It is designed to provide the level of proficiency needed to operate aeroplanes under IFR and in IMC. The course shall be taken within an ATO or consist of a combination of instrument flight instruction provided by an IRI(A) or an FI(A) holding the privilege to provide training for the IR and flight instruction within an ATO.

2. An applicant for such a competency-based modular IR(A) shall be the holder of a PPL(A) or CPL(A).

3. The course of theoretical instruction shall be completed within 18 months. The instrument flight instruction and the skill test shall be completed within the period of validity of the pass of the theoretical knowledge examinations.

4. The course shall comprise:

(a) theoretical knowledge instruction to the IR(A) knowledge level;

(b) instrument flight instruction.

THEORETICAL KNOWLEDGE

5. An approved competency-based modular IR(A) course shall comprise at least 80 hours of theoretical knowledge instruction. The theoretical knowledge course may contain computer-based training and e- learning elements. A minimum amount of classroom teaching as required by ORA.ATO.305 has to be provided.

FLYING TRAINING

6. The method of attaining an IR(A) following this modular course is competency based.

However, the minimum requirements below shall be completed by the applicant. Additional training may be required to reach required competencies.

(a) A single-engine competency-based modular IR(A) course shall include at least 40 hours of instrument time under instruction, of which up to 10 hours may be instrument ground time in an FNPT I, or up to 25 hours in an FFS or FNPT II. A maximum of 5 hours of FNPT II or FFS instrument ground time may be conducted in an FNPT I.

(i) When the applicant has:

(A) completed instrument flight instruction provided by an IRI(A) or an FI(A) holding the privilege to provide training for the IR; or

(B) prior experience of instrument flight time as PIC on aeroplanes, under a rating providing the privileges to fly under IFR and in IMC these hours may be credited towards the 40 hours above up to maximum of 30 hours,

(ii) When the applicant has prior instrument flight time under instruction other than specified in point (a)(i), these hours may be credited towards the required 40 hours up to a maximum of 15 hours.

(iii) In any case, the flying training shall include at least 10 hours of instrument flight time under instruction in an aeroplane at an ATO.

(iv) The total amount of dual instrument instruction shall not be less than 25 hours.

(b) A multi-engine competency-based modular IR(A) course shall include at least 45 hours instrument time under instruction, of which up to 10 hours may be instrument ground time in an FNPT I, or up to 30 hours in an FFS or FNPT II. A maximum of 5 hours of FNPT II or FFS instrument ground time may be conducted in an FNPT I.

(i) When the applicant has:

(A) completed instrument flight instruction provided by an IRI(A) or an FI(A) holding the privilege to provide training for the IR; or

(B) prior experience of instrument flight time as PIC on aeroplanes, under a rating giving the privileges to fly under IFR and in IMC these hours may be credited towards the 45 hours above up to a maximum of 35 hours.

(ii) When the applicant has prior instrument flight time under instruction other than specified in point (b)(i), these hours may be credited towards the required 45 hours up to a maximum of 15 hours.

(iii) In any case, the flying training shall include at least 10 hours of instrument flight time under instruction in a multi-engine aeroplane at an ATO.

(iv) The total amount of dual instrument instruction shall not be less than 25 hours, of which at least 15 hours shall be completed in a multi-engine aeroplane.

(c) To determine the amount of hours credited and to establish the training needs, the applicant shall complete a pre-entry assessment at an ATO.

(d) The completion of the instrument flight instruction provided by an IRI(A) or FI(A) in accordance with point (a)(i) or (b)(i) shall be documented in a specific training record and signed by the instructor.

7. The flight instruction for the competency-based modular IR(A) shall comprise:

(a) procedures and manoeuvres for basic instrument flight covering at least:

(i) basic instrument flight without external visual cues;

(ii) horizontal flight;

(iii) climbing;

(iv) descent;

(v) turns in level flight, climbing and descent;

(vi) instrument pattern;

(vii) steep turn;

(viii) radio navigation;

(ix) recovery from unusual attitudes;

(x) limited panel; and

(xi) recognition and recovery from incipient and full stall;

(b) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate air traffic services documents for the preparation of an IFR flight plan;

(c) procedure and manoeuvres for IFR operation under normal, abnormal, and emergency conditions covering at least:

(i) transition from visual to instrument flight on take-off;

(ii) standard instrument departures and arrivals;

(iii) en route IFR procedures;

(iv) holding procedures;

(v) instrument approaches to specified minima;

(vi) missed approach procedures; and

(vii) landings from instrument approaches, including circling;

(d) in-flight manoeuvres and particular flight characteristics;

(e) if required, operation of a multi-engine aeroplane in the above exercises, including:

(i) operation of the aeroplane solely by reference to instruments with one engine simulated inoperative;

(ii) engine shutdown and restart (to be carried out at a safe altitude unless carried out in an FFS or FNPT II).

8. Applicants for the competency-based modular IR(A) holding a Part-FCL PPL or CPL and a valid IR(A) issued in compliance with the requirements of Annex 1 to the Chicago Convention by a third country may be credited in full towards the training course mentioned in paragraph 4. In order to be issued the IR(A), the applicant shall:

(a) successfully complete the skill test for the IR(A) in accordance with Appendix 7;

(b) demonstrate to the examiner during the skill test that he/she has acquired an adequate level of theoretical knowledge of air law, meteorology and flight planning and performance (IR); and

(c) have a minimum experience of at least 50 hours of flight time under IFR as PIC on aeroplanes.

PRE-ENTRY ASSESSMENT

9. The content and duration of the pre-entry assessment shall be determined by the ATO based on the prior instrument experience of the applicant.

MULTI-ENGINE

10. The holder of a single-engine IR(A) who also holds a multi-engine class or type rating wishing to obtain a multi-engine IR(A) for the first time shall complete a course at an ATO comprising at least 5 hours instrument time under instruction in multi-engine aeroplanes, of which 3 hours may be in an FFS or FNPT II and shall pass a skill test.

B. IR(H) — Modular flying training course

1. The aim of the IR(H) modular flying training course is to train pilots to the level of proficiency necessary to operate helicopters under IFR and in IMC.

2. An applicant for a modular IR(H) course shall be the holder of a PPL(H), or a CPL(H) or an ATPL(H). Prior to commencing the aircraft instruction phase of the IR(H) course, the applicant shall be the holder of the helicopter type rating used for the IR(H) skill test, or have completed approved type rating training on that type. The applicant shall hold a certificate of satisfactory completion of MCC if the skill test is to be conducted in Multi- Pilot conditions.

3. An applicant wishing to undertake a modular IR(H) course shall be required to complete all the instructional stages in one continuous approved course of training.

4. The course of theoretical instruction shall be completed within 18 months. The flight instruction and the skill test shall be completed within the period of validity of the pass in the theoretical examinations.

5. The course shall comprise:

(a) theoretical knowledge instruction to the IR knowledge level;

(b) instrument flight instruction.

Theoretical knowledge

6. An approved modular IR(H) course shall comprise at least 150 hours of instruction.

FLYING TRAINING

7. A single-engine IR(H) course shall comprise at least 50 hours instrument time under instruction, of which:

(a) up to 20 hours may be instrument ground time in an FNPT I(H) or (A). These 20 hours instruction time in FNPT I (H) or (A) may be substituted by 20 hours instruction time for IR(H) in an aeroplane, approved for this course; or up to 35 hours may be instrument ground time in a helicopter FTD 2/3, FNPT II/III or FFS.

The instrument flight instruction shall include at least 10 hours in an IFR-certificated helicopter.

8. A multi-engine IR(H) course shall comprise at least 55 hours instrument time under instruction of which;

(a) up to 20 hours may be instrument ground time in an FNPT I (H) or (A). These 20 hours instruction time in FNPT I (H) or (A) may be substituted by 20 hours instruction time for IR(H) in an aeroplane, approved for this course, or up to 40 hours may be instrument ground time in a helicopter FTD 2/3, FNPT II/III or FFS.

The instrument flight instruction shall include at least 10 hours in an IFR-certificated multi-engine helicopter.

9.1 Holders of an ATPL(H) shall have the theoretical knowledge instruction hours reduced by 50 hours.

9.2 The holder of an IR(A) may have the amount of training required reduced to 10 hours.

9.3. The holder of a PPL(H) with a helicopter night rating or a CPL(H) may have the total amount of instrument time under instruction required reduced by 5 hours.

10. The flying exercises up to the IR(H) skill test shall comprise:

(a) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate air traffic services documents in the preparation of an IFR flight plan;

(b) procedure and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

transition from visual to instrument flight on take-off,

standard instrument departures and arrivals,

en-route IFR procedures,

holding procedures,

instrument approaches to specified minima, missed approach procedures,

landings from instrument approaches, including circling;

(c) in-flight manoeuvres and particular flight characteristics;

(d) if required, operation of a multi-engine helicopter in the above exercises, including operation of the helicopter solely by reference to instruments with one engine simulated inoperative and engine shutdown and restart (the latter exercise to be carried out in an FFS or FNPT II or FTD 2/3).

C. IR(As) — Modular flying training course

GENERAL

1. The aim of the IR(As) modular flying training course is to train pilots to the level of proficiency necessary to operate airships under IFR and in IMC. The course consists of two modules, which may be taken separately or combined:

(a) Basic Instrument Flight Module

This comprises 10 hours of instrument time under instruction, of which up to 5 hours can be instrument ground time in a BITD, FNPT I or II, or an FFS. Upon completion of the Basic Instrument Flight Module, the candidate shall be issued a Course Completion Certificate.

(b) Procedural Instrument Flight Module

This comprises the remainder of the training syllabus for the IR(As), 25 hours instrument time under instruction, and the theoretical knowledge course for the IR(As).

2. An applicant for a modular IR(As) course shall be the holder of a PPL(As) including the privileges to fly at night or a CPL(As). An applicant for the Procedural Instrument Flight Module, who does not hold a CPL(As), shall be holder of a Course Completion Certificate for the Basic Instrument Flight Module.

3. An applicant wishing to undertake the Procedural Instrument Flight Module of a modular IR(As) course shall be required to complete all the instructional stages in one continuous approved course of training. Prior to commencing the Procedural Instrument Flight Module, the ATO shall ensure the competence of the applicant in basic instrument flying skills. Refresher training shall be given as required.

4. The course of theoretical instruction shall be completed within 18 months. The Procedural Instrument Flight Module and the skill test shall be completed within the period of validity of the pass in theoretical examinations.

5. The course shall comprise:

(a) theoretical knowledge instruction to the IR knowledge level;

(b) instrument flight instruction.

THEORETICAL KNOWLEDGE

6. An approved modular IR(As) course shall comprise at least 150 hours of theoretical knowledge instruction.

FLYING TRAINING

7. An IR(As) course shall comprise at least 35 hours instrument time under instruction of which up to 15 hours may be instrument ground time in an FNPT I, or up to 20 hours in an FFS or FNPT II. A maximum of 5 hours of FNPT II or FFS instrument ground time may be conducted in an FNPT I.

8. The holder of a CPL(As) or of a Course Completion Certificate for the Basic Instrument Flight Module may have the total amount of training required in paragraph 7 reduced by 10 hours. The total instrument flight instruction in airship shall comply with paragraph 7.

9. If the applicant is the holder of an IR in another category of aircraft the total amount of flight instruction required may be reduced to 10 hours on airships.

10. The flying exercises up to the IR(As) skill test shall comprise:

(a) Basic Instrument Flight Module:

Procedure and manoeuvre for basic instrument flight covering at least:

basic instrument flight without external visual cues:

— horizontal flight,

— climbing,

— descent,

— turns in level flight, climbing, descent; instrument pattern; radio navigation; recovery from unusual attitudes; limited panel;

(b) Procedural Instrument Flight Module:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate air traffic services documents in the preparation of an IFR flight plan;

(ii) procedure and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

— transition from visual to instrument flight on take-off,

— standard instrument departures and arrivals,

— en-route IFR procedures,

— holding procedures,

— instrument approaches to specified minima,

— missed approach procedures,

— landings from instrument approaches, including circling;

(iii) inflight manoeuvres and particular flight characteristics;

(iv) operation of airship in the above exercises, including operation of the airship solely by reference to instruments with one engine simulated inoperative and engine shut-down and restart (the latter exercise to be carried out at a safe altitude unless carried out in an FFS or FNPT II).

GM1 to Appendix 3; Appendix 6; FCL.735.H

AMC1 to Appendix 6 Modular training course for the IR

ALL MODULAR FLYING TRAINING COURSES FOR THE IR, EXCEPT COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(a) The theoretical knowledge instruction may be given at an ATO conducting theoretical knowledge instruction only, in which case the HT of that organisation should supervise that part of the course.

(b) The 150 hours of theoretical knowledge instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course.

AMC2 to Appendix 6 Modular training course for the IR

SECTION A IR(A) - MODULAR FLYING TRAINING COURSE

Basic Instrument Flight Module Training Course

(a) This 10 hours module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitude recovery.

(b) All exercises may be performed in an FNPT I or II or an FFS, for a maximum of 5 hours. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(c) A BITD may be used for the exercises 1, 2, 3, 4, 6, and 8.

(d) The use of the BITD is subject to the following:

(1) the training should be complemented by exercises on an aeroplane;

(2) the record of the parameters of the flight must be available;

(3) an FI(A) or IRI(A) should conduct the instruction.

EXERCISES

(e) Exercise 1:

(1) basic instrument flying without 0:30 hours

external visual cues;

(2) horizontal flight;
power changes for

acceleration or deceleration;

(3) maintaining straight and level flight;

(4) turns in level flight with 15 °

and 25 ° bank, left and right;

(5) roll-out onto predetermined headings.

(f) Exercise 2:

(1) repetition of exercise 1; 0:45 hours

(2) additionally climbing, descending, maintaining heading and speed, transition to horizontal flight;

(3) climbing and descending turns.

(g) Exercise 3:

Instrument pattern: 0:45 hours

(1) start exercise, decelerate to approach speed, flaps into approach configuration;

(2) initiate standard turn (left or right);

(3) roll out on opposite heading, maintain new heading for 1 minute;

(4) standard turn, gear down, descend 500 ft/min;

(4) roll out on initial heading, maintain descent (500 ft/min) and new heading for 1 minute;

(5) transition to horizontal flight, 1000 ft below initial flight level;

(6) initiate go-around;

(7) climb at best rate of climb speed.

(h) Exercise 4:

Repetition of exercise 1 and steep turns with 45° bank; recovery from unusual 0:45 hours attitudes.

(i) Exercise 5:

Repetition of exercise 4. 0:45 hours

(j) Exercise 6:

(1) radio navigation using VOR, NDB or, if available, VDF; 0:45 hours

(2) interception of predetermined QDM, QDR.

(k) Exercise 7:

Repetition of exercise 1 and recovery from unusual attitudes. 0:45 hours

(l) Exercise 8:

(1) Repetition of exercise 1; 0:45 hours

(2) turns, level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.

(m) Exercise 9:

Recognition of, and recovery from, incipient and full stalls. 0:45 hours

(n) Exercise 10: Repetition of exercises 6, 8 and 9. 3:30 hours

Certificate of Completion of Basic instrument Flight Module

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

Pilot’s last name(s):		First name(s):	
Type of licence:		Number:	State:

Flight training hours performed on SE aeroplane:		OR	Flight training hours performed on ME aeroplane:	
Flight training hours performed in an FSTD (maximum 5 hours):				
	Signature of applicant:			

The satisfactory completion of basic instrument flight module according to requirements is certified below:

TRAINING			
Basic instrument flight module training received during period:			
from:	to:	at:	ATO
Location and date:		Signature of head of training:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

AMC3 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(a) THEORETICAL KNOWLEDGE INSTRUCTION

(1) The theoretical knowledge instruction may be given at an approved training organisation conducting theoretical knowledge instruction only, in which case the Head of Training of that organisation should supervise that part of the course.

(2) The required theoretical knowledge instruction for the IR following the competency-based route may contain computer-based training, e-learning elements, interactive video, slide/tape presentation, learning carrels and other media as approved by the authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom teaching has to be provided as required by ORA.ATO.305.

(b) THEORETICAL KNOWLEDGE EXAMINATION

The applicant for the IR following the competency-based training route should pass an examination to demonstrate a level of theoretical knowledge appropriate to the privileges granted in the subjects further detailed in FCL.615(b). The number of questions per subject, the distribution of questions and the time allocated to each subject is detailed in AMC2 ARA.FCL.300(b).

AMC4 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

FLYING TRAINING

(a) The instrument flight instruction outside an ATO provided by an IRI(A) or an FI(A) holding the privilege to provide training for the IR in accordance with Appendix 6 Section Aa (6)(a)(i)(A) may consist of instrument flight time under instruction or instrument ground time or a combination thereof.

TRAINING AIRCRAFT

(b) The aeroplane used for the instrument flight training provided outside an ATO by an IRI(A) or FI(A) should be:

(1) fitted with primary flight controls that are instantly accessible by both the student and the instructor (for example dual flight controls or a centre control stick). Swing-over flight controls should not be used; and

(2) suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required.

(c) The FSTD used for the instrument flight instruction provided outside an ATO by an IRI(A) or FI(A) should be suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required

AMC5 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (6)(a)(i)(B); (6)(b)(i)(B)

PRIOR EXPERIENCE OF FLIGHT TIME UNDER IFR AS PIC

A rating giving privileges to fly under IFR and in IMC referred to in (6)(a)(i)(B) and (6)(b)(i)(B) may be any of the following:

(a) an EIR rating issued by a competent authority of a Member State; or

(b) a national instrument rating issued by a Member State prior to the application of Commission Regulation (EU) No 1178/2011; or

(c) an instrument rating issued in compliance with the requirements of Annex 1 to the Chicago Convention by a third country; or

(d) an authorisation issued by a Member State under Article 4(8) of Commission Regulation (EU) No 1178/2011.

The amount of credit given should not exceed the amount of hours completed as instrument flight time.

AMC6 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (6)(a)(ii); (6)(b)(ii)

PRIOR INSTRUMENT FLIGHT TIME UNDER INSTRUCTION

Prior instrument flight time under instruction on aeroplanes, as referred in (6)(a)(ii) and (6)(b)(ii), may be instrument flight time completed for the issue of:

(a) an EIR rating issued by a competent authority of a Member State; or

(b) a national instrument rating prior to the application of Commission Regulation (EU) No 1178/2011; or

(c) an instrument rating in compliance with the requirements of Annex 1 to the Chicago Convention by a third country; or

(d) an authorisation issued by a Member State under Article 4(8) of Commission Regulation (EU) No 1178/2011.

AMC7 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (6)(c); (6)(d)
PRE-ENTRY ASSESSMENT AND TRAINING RECORD
(a) PRE-ENTRY ASSESSMENT
The assessment to establish the amount of training to be credited and to identify the training needs should be based on the training syllabus established in Appendix 6 Aa.
(b) TRAINING RECORD
(1) Before initiating the assessment the applicant should provide to an ATO a training record containing the details of the previous flight instruction provided by the IRI(A) or the FI(A). This training record should at least specify the aircraft type and registration used for the training, the number of flights and the total amount of instrument time under instruction. It should also specify all the exercises completed during the training by using the syllabus contained in Appendix 6 Aa.
(2) The instructor having provided the training should keep the training records containing all the details of the flight training given for a period of at least 5 years after the completion of the training.

AMC8 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (8)
In order to be credited in full towards the multi-engine IR(A) training course requirements, the applicant should
(a) hold a multi-engine IR(A), issued in accordance with the requirements of Annex 1 to the Chicago Convention by a third country;
(b) have the minimum experience required in Appendix 6 Aa paragraph 8(c), of which at least 15 hours should be completed in a multi-engine aeroplane.

AMC9 to Appendix 6 Modular training courses for the IR

AIRSHIPS
Basic Instrument Flight Module Training Course

(a) This 10 hours module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitude recovery.

(b) All exercises may be performed in an FNPT I or II or an FFS, for a maximum of 5 hours. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(c) A BITD may be used for the exercises 1, 2, 3, 4, 6 and 8.

(d) The use of the BITD is subject to the following:
   (1) the training should be complemented by exercises on an airship;
   (2) the record of the parameters of the flight must be available;
   (3) an FI(As) or IRI(As) should conduct the instruction.

EXERCISES

(e) Exercise 1:

(1) basic instrument flying without external visual cues; 0:30 hours
(2) horizontal flight;
(3) maintaining straight and

	level flight; (4) turns in level flight, left and right; (5) rollout onto predetermined headings.	
(f)	Exercise 2:	
	(1) Repetition of exercise 1; additionally climbing and descending (2) maintaining heading and speed; (3) transition to horizontal flight; (4) climbing and descending turns.	0:45 hours
(g)	Exercise 3:	
	Instrument pattern: (1) start exercise, decelerate to approach speed, approach configuration; (2) initiate standard turn (left or right); (3) rollout on opposite heading, maintain new heading for 1 minute; (4) standard turn, descend with given rate (for example 500 ft/min); (5) rollout on initial heading, maintain descent (for example 500 ft/min) and new heading for 1 minute; (6) transition to horizontal flight (for example 1000 ft below initial level); (7) initiate go-around; (8) climb at best rate of climb speed.	0:45 hours
(h)	Exercise 4:	
	(1) repetition of exercise 1;	0:45 hours

(2) recovery from unusual attitudes.

(i) Exercise 5

Repetition of exercise 4. 0:45 hours

(j) Exercise 6

(1) radio navigation using VOR, NDB or, if available, VDF; 0:45 hours

(2) interception of predetermined QDM, QDR.

(k) Exercise 7

(1) repetition of exercise 1; 0:45 hours

(2) recovery from unusual attitudes.

(l) Exercise 8

(1) repetition of exercise 1; 0:45 hours

(2) turns, level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.

(m) Exercise 9

Repetition of exercises (6) and (8). 4:15 hours

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

Pilot's last name(s):		First name(s):	
Type of licence:		Number:	State:
Flight training hours performed on airship:			

Flight training hours performed in an FSTD (maximum 5 hours):		
	Signature of applicant:	

The satisfactory completion of basic instrument flight module according to requirements is certified below:

TRAINING			
Basic instrument flight module training received during period:			
from:	to:	at:	ATO
Location and date:		Signature of head of training:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

Appendix 7 - IR skill test

1. An applicant for an IR shall have received instruction on the same class or type of aircraft to be used in the test which shall be appropriately equipped for the training and testing purposes.

2. An applicant shall pass all the relevant sections of the skill test. If any item in a section is failed, that section is failed. Failure in more than one section will require the applicant to take the entire test again. An applicant failing only one section shall only repeat the failed section. Failure in any section of the retest, including those sections that have been passed on a previous attempt, will require the applicant to take the entire test again. All relevant sections of the skill test shall be completed within 6 months. Failure to achieve a pass in all relevant sections of the test in two attempts will require further training.

3. Further training may be required following a failed skill test. There is no limit to the number of skill tests that may be attempted.

CONDUCT OF THE TEST

4. The test is intended to simulate a practical flight. The route to be flown shall be chosen by the examiner. An essential element is the ability of the applicant to plan and conduct the flight from routine briefing material. The applicant shall undertake the flight planning and shall ensure that all equipment and documentation for the execution of the flight are on board. The duration of the flight shall be at least 1 hour.

5. Should the applicant choose to terminate a skill test for reasons considered inadequate by the examiner, the applicant shall retake the entire skill test. If the test is terminated for reasons considered adequate by the examiner, only those sections not completed shall be tested in a further flight.

6. At the discretion of the examiner, any manoeuvre or procedure of the test may be repeated once by the applicant. The examiner may stop the test at any stage if it is considered that the applicant’s demonstration of flying skill requires a complete retest.

7. An applicant shall fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if there is no other crew member. The examiner shall take no part in the operation of the aircraft, except when intervention is necessary in the interests of safety or to avoid unacceptable delay to other traffic. Responsibility for the flight shall be allocated in accordance with national regulations.

8. Decision heights/altitude, minimum descent heights/altitudes and missed approach point shall be determined by the applicant and agreed by the examiner.

9. An applicant for an IR shall indicate to the examiner the checks and duties carried out, including the identification of radio facilities. Checks shall be completed in accordance with the authorised checklist for the aircraft on which the test is being taken. During pre-flight preparation for the test the applicant is required to determine power settings and speeds. Performance data for take-off, approach and landing shall be calculated by the applicant in compliance with the operations manual or flight manual for the aircraft used.

FLIGHT TEST TOLERANCES

10. The applicant shall demonstrate the ability to:

operate the aircraft within its limitations;

complete all manoeuvres with smoothness and accuracy;

exercise good judgment and airmanship;

apply aeronautical knowledge; and

maintain control of the aircraft at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

11. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the aircraft used.

Height	
Generally	± 100 feet
Starting a go-around at decision height/altitude	+ 50 feet/– 0 feet
Minimum descent height/MAP/altitude	+ 50 feet/– 0 feet
Tracking	
On radio aids	± 5°
For angular deviations	Half scale deflection, azimuth and glide path (e.g. LPV, ILS, MLS, GLS)
2D (LNAV) and 3D (LNAV/VNAV) “linear” lateral deviations	cross-track error/deviation shall normally be limited to ± ½ the RNP value associated with the procedure. Brief deviations from this standard up to a maximum of 1 time the RNP value are allowable.
3D linear vertical deviations (e.g. RNP APCH (LNAV/VNAV) using BaroVNAV)	not more than – 75 feet below the vertical profile at any time, and not more than + 75 feet above the vertical profile at or below 1 000 feet above aerodrome level.
Heading	
all engines operating	± 5°
with simulated engine failure	± 10°
Speed	
all engines operating	± 5 knots
with simulated engine failure	+ 10 knots/– 5 knots

CONTENT OF THE TEST

Aeroplanes

SECTION 1 — PRE-FLIGHT OPERATIONS AND DEPARTURE Use of checklist, airmanship, anti-icing/de-icing procedures, etc., apply in all sections	
a	Use of flight manual (or equivalent) especially a/c performance calculation, mass and balance
b	Use of Air Traffic Services document, weather document
c	Preparation of ATC flight plan, IFR flight plan/log
d	Identification of the required navaids for departure, arrival and approach procedures
e	Pre-flight inspection
f	Weather Minima
g	Taxiing
h	PBN departure (if applicable): — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the departure chart.
i	Pre-take-off briefing, Take-off
j(◦)	Transition to instrument flight
k(◦)	Instrument departure procedures, including PBN departures, and altimeter setting
l(◦)	ATC liaison — compliance, R/T procedures
SECTION 2 — GENERAL HANDLING (o)	
a	Control of the aeroplane by reference solely to instruments, including: level flight at various speeds, trim
b	Climbing and descending turns with sustained Rate 1 turn
c	Recoveries from unusual attitudes, including sustained 45° bank turns and steep descending turns
d(*)	Recovery from approach to stall in level flight, climbing/ descending turns and in landing configuration — only applicable to aeroplanes
e	Limited panel: stabilised climb or descent, level turns at Rate 1 onto given headings, recovery from unusual attitudes — only applicable to aeroplanes
SECTION 3 — EN-ROUTE IFR PROCEDURES (o)	
a	Tracking, including interception, e.g. NDB, VOR, or track between waypoints
b	Use of navigation system and radio aids
c	Level flight, control of heading, altitude and airspeed, power setting, trim technique
d	Altimeter settings
e	Timing and revision of ETAs (en-route hold, if required)
f	Monitoring of flight progress, flight log, fuel usage, systems' management
g	Ice protection procedures, simulated if necessary
h	ATC liaison — compliance, R/T procedures
SECTION 3a — ARRIVAL PROCEDURES	
a	Setting and checking of navigational aids, if applicable
b	Arrival procedures, altimeter checks
c	Altitude and speed constraints, if applicable
d	PBN arrival (if applicable): — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the arrival chart.
SECTION 4(°) — 3D Operations(++)	

a	Setting and checking of navigational aids Check Vertical Path angle For RNP APCH: — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the approach chart.
b	Approach and landing briefing, including descent/approach/landing checks, including identification of facilities
c(+)	Holding procedure
d	Compliance with published approach procedure
e	Approach timing
f	Altitude, speed heading control (stabilised approach)
g(+)	Go-around action
h(+)	Missed approach procedure/landing
i	ATC liaison — compliance, R/T procedures
SECTION 5(°) – 2D OPERATIONS(++)	
a	Setting and checking of navigational aids For RNP APCH: — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the approach chart.
b	Approach and landing briefing, including descent/approach/landing checks, including identification of facilities
c(+)	Holding procedure
d	Compliance with published approach procedure
e	Approach timing
f	Altitude/Distance to MAPT, speed, heading control (stabilised approach), Stop Down Fixes (SDF(s)), if applicable
g(+)	Go-around action
h(+)	Missed approach procedure/landing
i(+)	ATC liaison — compliance, R/T procedures
SECTION 6 — FLIGHT WITH ONE ENGINE INOPERATIVE (multi- engine aeroplanes only) (o)	
a	Simulated engine failure after take-off or on go-around
b	Approach, go-around and procedural missed approach with one engine inoperative
c	Approach and landing with one engine inoperative
d	ATC liaison — compliance, R/T procedures

(°) Must be performed by sole reference to instruments.

(*) May be performed in an FFS, FTD 2/3 or FNPT II.

(+) May be performed in either Section 5 or Section 6.

(++) To establish or maintain PBN privileges one approach in either Section 4 or Section 5 shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.

Helicopters

SECTION 1 — DEPARTURE Use of checklist, airmanship, anti-icing/de-icing procedures, etc., apply in all sections	
a	Use of flight manual (or equivalent) especially aircraft performance calculation; mass and balance
b	Use of Air Traffic Services document, weather document

c	Preparation of ATC flight plan, IFR flight plan/log
d	Identification of the required navaids for departure, arrival and approach procedures
e	Pre-flight inspection
f	Weather minima
g	Taxiing/Air taxy in compliance with ATC or instructions of instructor
h	PBN departure (if applicable): — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the departure chart.
j	Pre-take-off briefing, procedures and checks
k	Transition to instrument flight
i	Instrument departure procedures, including PBN prodecures
SECTION 2 — GENERAL HANDLING	
a	Control of the helicopter by reference solely to instruments, including:
b	Climbing and descending turns with sustained Rate 1 turn
c	Recoveries from unusual attitudes, including sustained 30° bank turns and steep descending turns
SECTION 3 — EN-ROUTE IFR PROCEDURES	
a	Tracking, including interception, e.g. NDB, VOR, RNAV
b	Use of radio aids
c	Level flight, control of heading, altitude and airspeed, power setting
d	Altimeter settings
e	Timing and revision of ETAs
f	Monitoring of flight progress, flight log, fuel usage, systems management
g	Ice protection procedures, simulated if necessary and if applicable
h	ATC liaison — compliance, R/T procedures
SECTION 3a — ARRIVAL PROCEDURES	
a	Setting and checking of navigational aids, if applicable
b	Arrival procedures, altimeter checks
c	Altitude and speed constraints, if applicable
d	PBN arrival (if applicable) — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the arrival chart.
SECTION 4 — 3D OPERATIONS(+)	
a	Setting and checking of navigational aids Check Vertical Path angle For RNP APCH: (a) Check that the correct procedure has been loaded in the navigation system; and (b) Cross-check between the navigation system display and the approach chart.
b	Approach and landing briefing, including descent/approach/landing checks
c(*)	Holding procedure
d	Compliance with published approach procedure
e	Approach timing
f	Altitude, speed, heading control (stabilised approach)
g(*)	Go-around action

h(*)	Missed approach procedure/landing
i	ATC liaison — compliance, R/T procedures
SECTION 5 — 2D OPERATIONS(+)	
a	Setting and checking of navigational aids For RNP APCH: — Check that the correct procedure has been loaded in the navigation system; and — Cross-check between the navigation system display and the approach chart.
b	Approach and landing briefing, including descent/approach/landing checks and identification of facilities
c(*)	Holding procedure
d	Compliance with published approach procedure
e	Approach timing
f	Altitude, speed, heading control (stabilised approach)
g(*)	Go-around action
h(*)	Missed approach procedure (*)/landing
i	ATC liaison — compliance, R/T procedures
SECTION 6 — ABNORMAL AND EMERGENCY PROCEDURES This section may be combined with sections 1 through 5. The test shall have regard to control of the helicopter, identification of the failed engine, immediate actions (touch drills), follow-up actions and checks and flying accuracy, in the following situations:	
a	Simulated engine failure after take-off and on/during approach (**) (at a safe altitude unless carried out in an FFS or FNPT II/III, FTD 2,3)
b	Failure of stability augmentation devices/hydraulic system (if applicable)
c	Limited panel
d	Autorotation and recovery to a pre-set altitude
e	Precision approach manually without flight director (***) Precision approach manually with flight director (***)

(+) To establish or maintain PBN privileges one approach in either Section 4 or Section 5 shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD

(*) To be performed in Section 4 or Section 5.

(**) Multi-engine helicopter only.

(***) Only one item to be tested

Airships

SECTION 1 — PRE-FLIGHT OPERATIONS AND DEPARTURE Use of checklist, airmanship, ATC liaison compliance, R/T procedures, apply in all sections	
a	Use of flight manual (or equivalent) especially a/c performance calculation, mass and balance
b	Use of Air Traffic Services document, weather document
c	Preparation of ATC flight plan, IFR flight plan/log
d	Pre-flight inspection
e	Weather minima
f	Pre-take-off briefing, off mast procedure, manoeuvring on ground
g	Take-off
h	Transition to instrument flight

i	Instrument departure procedures, altimeter setting
j	ATC liaison — compliance, R/T procedures
SECTION 2 — GENERAL HANDLING	
a	Control of the airship by reference solely to instruments
b	Climbing and descending turns with sustained rate of turn
c	Recoveries from unusual attitudes
d	Limited panel
SECTION 3 — EN-ROUTE IFR PROCEDURES	
a	Tracking, including interception, e.g. NDB, VOR, RNAV
b	Use of radio aids
c	Level flight, control of heading, altitude and airspeed, power setting, trim technique
d	Altimeter settings
e	Timing and revision of ETAs
f	Monitoring of flight progress, flight log, fuel usage, systems' management
g	ATC liaison — compliance, R/T procedures
SECTION 4 — PRECISION APPROACH PROCEDURES	
a	Setting and checking of navigational aids, identification of facilities
b	Arrival procedures, altimeter checks
c	Approach and landing briefing, including descent/approach/landing checks
d(+)	Holding procedure
e	Compliance with published approach procedure
f	Approach timing
g	Stabilised approach (altitude, speed and heading control)
h(+)	Go-around action
i(+)	Missed approach procedure/landing
j	ATC liaison — compliance, R/T procedures
SECTION 5 — NON-PRECISION APPROACH PROCEDURES	
a	Setting and checking of navigational aids, identification of facilities
b	Arrival procedures, altimeter settings
c	Approach and landing briefing, including descent/approach/landing checks
d(+)	Holding procedure
e	Compliance with published approach procedure
f	Approach timing
g	Stabilised approach (altitude, speed and heading control)
h(+)	Go-around action
i(+)	Missed approach procedure/landing
j	ATC liaison — compliance, R/T procedures
SECTION 6 — FLIGHT WITH ONE ENGINE INOPERATIVE This section may be combined with sections 1 through 5. The test shall have regard to control of the airship, identification of the failed engine, immediate actions, follow-up actions, checks and flying accuracy in the following situations:	
a	Simulated engine failure after take-off or on go-around
b	Approach and procedural go-around with one engine inoperative
c	Approach and landing, missed approach procedure, with one engine inoperative

d	ATC liaison — compliance, R/T procedures
(+) May be performed in either section 4 or section 5.	

GM1 to Appendix 7 IR skill test

To the skill test, an ME centreline thrust aeroplane is considered an SE aeroplane.

AMC1 to Appendix 7 IR skill test

LAPL, BPL, SPL, PPL, CPL, IR SKILL TEST AND PROFICIENCY CHECK APPLICATION AND REPORT FORM

APPLICATION AND REPORT FORM LAPL, BPL, SPL, PPL, CPL, IR SKILL TEST AND PROFICIENCY CHECK			
Applicant's last name(s):			
Applicant's first name(s):			**LAPL: A ☐ H ☐ B ☐ S ☐**
Signature of applicant:			**BPL: ☐ SPL: ☐**
Type of licence*:			**PPL: A ☐ H ☐ As ☐**
Licence number*:			**CPL: A ☐ H ☐ As ☐**
State:			**IR: A ☐ H ☐ As ☐**
1	**Details of the flight**		
Group, class, type of aircraft:		**Registration:**	
Aerodrome or site:	**Take-off time:**	**Landing time:**	**Flight time:**
			Total flight time:
2	**Result of the test**		
Skill test details:			
Pass ☐	**Fail** ☐	**Partial pass** ☐	
3	**Remarks**		

Location and date:	
Examiner's certificate number *:	**Type and number of licence:**
Signature of examiner:	**Name(s) in capital letters:**

if applicable

Appendix 8 - Cross-crediting of the IR part of a class or type rating proficiency check

A. **Aeroplanes**

Credits shall be granted only when the holder is revalidating IR privileges for single-engine and single-pilot multi-engine aeroplanes, as appropriate.

When a proficiency check including IR is performed, and the holder has a valid:	Credit is valid towards the IR part in a proficiency check for:
MP type rating; High performance complex aeroplane type rating	SE class * and SE type rating *, and SP ME class, and SP ME non-high performance complex aeroplane type rating, only credits for section 3B of the skill test for single pilot non-high performance complex aeroplane of Appendix 9 *
SP ME non-high performance complex aeroplane type rating, operated as single-pilot	SP ME class *, and SP ME non-high performance complex aeroplane type rating, and SE class and type rating *
SP ME non-high performance complex aeroplane type rating, restricted to MP operation	a. SP ME class *, and b. SP ME non-high performance complex aeroplane type rating *, and c. SE class and type rating *
SP ME class rating, operated as single-pilot	SE class and type rating, and SP ME class, and SP ME non-high performance complex aeroplane type rating SP ME class rating, restricted to MP operation SE class and type rating *, and SP ME class *, and SP ME non-high performance complex aeroplane type rating *
SP SE class rating	SE class and type rating
SP SE type rating	SE class and type rating

* Provided that within the preceding 12 months the applicant has flown at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach on an SP class or type of aeroplane in SP operations, or, for multi-engine, other than HP complex aeroplanes, the applicant has passed section 6 of the skill test for SP, other than HP complex aeroplanes flown solely by reference to instruments in SP operations.

B. **Helicopters**

Credits shall be granted only when the holder is revalidating IR privileges for single-engine and single-pilot multi-engine helicopters as appropriate.

When a proficiency check, including IR, is performed and the holder has a valid:	Credit is valid towards the IR part in a proficiency check for:
MPH type rating	SE type rating *, and SP ME type rating *.
SP ME type rating, operated as single-pilot	SE type rating, SP ME type rating.
SP ME type rating, restricted to multi-pilot operation	SE type rating, * SP ME type rating *.

* Provided that within the preceding 12 months at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach (could be a Point in Space (PinS) approach), have been performed on a SP type of helicopter in SP operations.

Appendix 9 - Training, skill test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

A. **General**

1. An applicant for a skill test shall have received instruction on the same class or type of aircraft to be used in the test.

2. Failure to achieve a pass in all sections of the test in two attempts will require further training.

3. There is no limit to the number of skill tests that may be attempted.

CONTENT OF THE TRAINING, SKILL TEST/PROFICIENCY CHECK

4. Unless otherwise determined in the operational suitability data established in accordance with Part-21, the syllabus of flight instruction, the skill test and the proficiency check shall comply with this Appendix. The syllabus, skill test and proficiency check may be reduced to give credit for previous experience on similar aircraft types, as determined in the operational suitability data established in accordance with Part-21.

5. Except in the case of skill tests for the issue of an ATPL, when so defined in the operational suitability data established in accordance with Part-21 for the specific aircraft, credit may be given for skill test items common to other types or variants where the pilot is qualified.

CONDUCT OF THE TEST/CHECK

6. The examiner may choose between different skill test or proficiency check scenarios containing simulated relevant operations developed and approved by the competent authority. Full flight simulators and other training devices, when available, shall be used, as established in this Part.

7. During the proficiency check, the examiner shall verify that the holder of the class or type rating maintains an adequate level of theoretical knowledge.

8. Should the applicant choose to terminate a skill test for reasons considered inadequate by the examiner, the applicant shall retake the entire skill test. If the test is terminated for reasons considered adequate by the examiner, only those sections not completed shall be tested in a further flight.

9. At the discretion of the examiner, any manoeuvre or procedure of the test may be repeated once by the applicant. The examiner may stop the test at any stage if it is considered that the applicant's demonstration of flying skill requires a complete re-test.

10. An applicant shall be required to fly the aircraft from a position where the PIC or co-pilot functions, as relevant, can be performed and to carry out the test as if there is no other crew member if taking the test/check under single- pilot conditions. Responsibility for the flight shall be allocated in accordance with national regulations.

11. During pre-flight preparation for the test the applicant is required to determine power settings and speeds. The applicant shall indicate to the examiner the checks and duties carried out, including the identification of radio facilities. Checks shall be completed in accordance with the check-list for

the aircraft on which the test is being taken and, if applicable, with the MCC concept. Performance data for take-off, approach and landing shall be calculated by the applicant in compliance with the operations manual or flight manual for the aircraft used. Decision heights/altitude, minimum descent heights/altitudes and missed approach point shall be agreed upon with the examiner.

12. The examiner shall take no part in the operation of the aircraft except where intervention is necessary in the interests of safety or to avoid unacceptable delay to other traffic.

SPECIFIC REQUIREMENTS FOR THE SKILL TEST/PROFICIENCY CHECK FOR MULTI-PILOT AIRCRAFT TYPE RATINGS, FOR SINGLE-PILOT AEROPLANE TYPE RATINGS, WHEN OPERATED IN MULTI-PILOT OPERATIONS, FOR MPL AND ATPL

13. The skill test for a multi-pilot aircraft or a single-pilot aeroplane when operated in multi-pilot operations shall be performed in a multi-crew environment. Another applicant or another type rated qualified pilot may function as second pilot. If an aircraft is used, the second pilot shall be the examiner or an instructor.

14. The applicant shall operate as PF during all sections of the skill test, except for abnormal and emergency procedures, which may be conducted as PF or PNF in accordance with MCC. The applicant for the initial issue of a multi- pilot aircraft type rating or ATPL shall also demonstrate the ability to act as PNF. The applicant may choose either the left hand or the right hand seat for the skill test if all items can be executed from the selected seat.

15. The following matters shall be specifically checked by the examiner for applicants for the ATPL or a type rating for multi-pilot aircraft or for multi-pilot operations in a single-pilot aeroplane extending to the duties of a PIC, irrespective of whether the applicant acts as PF or PNF:

(a) management of crew cooperation;

(b) maintaining a general survey of the aircraft operation by appropriate supervision; and

(c) setting priorities and making decisions in accordance with safety aspects and relevant rules and regulations appropriate to the operational situation, including emergencies.

16. The test/check should be accomplished under IFR, if the IR rating is included, and as far as possible be accomplished in a simulated commercial air transport environment. An essential element to be checked is the ability to plan and conduct the flight from routine briefing material.

17. When the type rating course has included less than 2 hours flight training on the aircraft, the skill test may be conducted in an FFS and may be completed before the flight training on the aircraft. In that case, a certificate of completion of the type rating course including the flight training on the aircraft shall be forwarded to the competent authority before the new type rating is entered in the applicant's licence.

B. **Specific requirements for the aeroplane category**

PASS MARKS

1. In the case of single-pilot aeroplanes, with the exception of for single-pilot high performance complex aeroplanes, the applicant shall pass all sections of the skill test or proficiency check. If any

item in a section is failed, that section is failed. Failure in more than one section will require the applicant to take the entire test or check again. Any applicant failing only one section shall take the failed section again. Failure in any section of the re-test or re- check including those sections that have been passed at a previous attempt will require the applicant to take the entire test or check again. For single- pilot multi-engine aeroplanes, section 6 of the relevant test or check, addressing asymmetric flight, shall be passed.

2. In the case of multi-pilot and single-pilot high performance complex aeroplanes, the applicant shall pass all sections of the skill test or proficiency check. Failure of more than five items will require the applicant to take the entire test or check again. Any applicant failing five or less items shall take the failed items again. Failure in any item on the re-test or re-check including those items that have been passed at a previous attempt will require the applicant to take the entire check or test again. Section 6 is not part of the ATPL or MPL skill test. If the applicant only fails or does not take section 6, the type rating will be issued without CAT II or CAT III privileges. To extend the type rating privileges to CAT II or CAT III, the applicant shall pass the section 6 on the appropriate type of aircraft.

FLIGHT TEST TOLERANCE

3. The applicant shall demonstrate the ability to:

(a) operate the aeroplane within its limitations;

(b) complete all manoeuvres with smoothness and accuracy;

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge;

(e) maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is always assured;

(f) understand and apply crew coordination and incapacitation procedures, if applicable; and

(g) communicate effectively with the other crew members, if applicable.

4. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the aeroplane used:

Height	
Generally	± 100 feet
Starting a go-around at decision height/altitude	+ 50 feet/– 0 feet
Minimum descent height/MAP/altitude	+ 50 feet/– 0 feet
Tracking	
on radio aids	± 5°

For "angular" deviations	Half scale deflection, azimuth and glide path (e.g. LPV, ILS, MLS, GLS)
2D (LNAV) and 3D (LNAV/VNAV) "linear" lateral deviations	cross-track error/deviation shall normally be limited to ± ½ the RNP value associated with the procedure. Brief deviations from this standard up to a maximum of 1 time the RNP value are allowable.
3D linear vertical deviations (e.g. RNP APCH (LNAV/VNAV) using BaroVNAV)	not more than – 75 feet below the vertical profile at any time, and not more than + 75 feet above the vertical profile at or below 1 000 feet above aerodrome level.

Heading

all engines operating	± 5°
with simulated engine failure	± 10°

Speed

all engines operating	± 5 knots
with simulated engine failure	+ 10 knots/– 5 knots

CONTENT OF THE TRAINING/SKILL TEST/PROFICIENCY CHECK

5. Single-pilot aeroplanes, except for high performance complex aeroplanes:

(a) The following symbols mean:

P = Trained as PIC or Co-pilot and as Pilot Flying (PF) and Pilot Not Flying (PNF)
X = Flight simulators shall be used for this exercise, if available, otherwise an aeroplane shall be used if appropriate for the manoeuvre or procedure
P# = The training shall be complemented by supervised aeroplane inspection

(b) The practical training shall be conducted at least at the training equipment level shown as (P), or may be conducted on any higher level of equipment shown by the arrow (—>)

The following abbreviations are used to indicate the training equipment used:

A = Aeroplane
FFS = Full Flight Simulator
FTD = Flight Training Device (including FNPT II for ME class rating)

(c) The starred (*) items of section 3B and, for multi-engine, section 6, shall be flown solely by reference to instruments if revalidation/renewal of an IR is included in the skill test or proficiency check. If the starred (*) items are not flown solely by reference to instruments during the skill test or proficiency check, and when there is no crediting of IR privileges, the class or type rating will be restricted to VFR only.

(d) Section 3A shall be completed to revalidate a type or multi-engine class rating, VFR only, where the required experience of 10 route sectors within the previous 12 months has not been completed. Section 3A is not required if section 3B is completed.

(e) Where the letter 'M' appears in the skill test or proficiency check column this will indicate the mandatory exercise or a choice where more than one exercise appears.

(f) An FFS or an FNPT II shall be used for practical training for type or multi-engine class ratings if they form part of an approved class or type rating course. The following considerations will apply to the approval of the course:

(i) the qualification of the FFS or FNPT II as set out in the relevant requirements of Part-ARA and Part-ORA;

(ii) the qualifications of the instructors;

(iii) the amount of FFS or FNPT II training provided on the course; and

(iv) the qualifications and previous experience on similar types of the pilot under training.

(g) When a skill test or proficiency check is performed in multi-pilot operations, the type rating shall be restricted to multi-pilot operations.

(h) To establish or maintain PBN privileges one approach shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
SECTION 1						
1 Departure 1.1 Pre-flight including: Documentation Mass and Balance Weather briefing NOTAM						
1.2 Pre-start checks						

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
1.2.1 External	P#		P			
1.2.2 Internal			P		M	
1.3 Engine starting: Normal Malfunctions	P---->	---->	---->		M	
1.4 Taxiing		P---->	---->		M	
1.5 Pre-departure checks: Engine run-up (if applicable)	P---->	---->	---->		M	
1.6 Take-off procedure: Normal with Flight Manual flap settings Crosswind (if conditions available)		P---->	---->		M	
1.7 Climbing: Vx/Vy Turns onto headings Level off		P---->	---->		M	
1.8 ATC liaison – Compliance, R/T procedure						
SECTION 2						

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
2 Airwork (VMC) 2.1 Straight and level flight at various airspeeds including flight at critically low airspeed with and without flaps (including approach to VMCA when applicable)		P---->	---->			
2.2 Steep turns (360° left and right at 45° bank)		P---->	---->		M	
2.3 Stalls and recovery: (i) Clean stall (ii) Approach to stall in descending turn with bank with approach configuration and power (iii) Approach to stall in landing configuration and power (iv) Approach to stall, climbing turn with take-off flap and climb power (single engine aeroplane only)		P---->	---->		M	
2.4 Handling using autopilot and flight director (may be conducted in section 3) if applicable		P---->	---->		M	
2.5 ATC liaison – Compliance, R/T procedure						
SECTION 3A						

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3A En-route procedures VFR (see B.5 (c) and (d)) 3A.1 Flight plan, dead reckoning and map reading						
3A.2 Maintenance of altitude, heading and speed						
3A.3 Orientation, timing and revision of ETAs						
3A.4 Use of radio navigation aids (if applicable)						
3A.5 Flight management (flight log, routine checks including fuel, systems and icing)						
3A.6 ATC liaison – Compliance, R/T procedure						
SECTION 3B						
3B Instrument flight 3B.1* Departure IFR		P---->	---->		M	
3B.2* En-route IFR		P---->	---->		M	
3B.3* Holding procedures		P---->	---->		M	

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3B.4* 3D operations to DH/A of 200 feet (60 m) or to higher minima if required by the approach procedure (autopilot may be used to the final approach segment vertical path intercept)		P---->	---->		M	
3B.5* 2D operations to MDH/A		P---->	---->		M	
3B.6* Flight exercises including simulated failure of the compass and attitude indicator: rate 1 turns, recoveries from unusual attitudes	P---->	---->	---->		M	
3B.7* Failure of localiser or glideslope	P---->	---->	---->			
3B.8* ATC liaison – Compliance, R/T procedure						
Intentionally left blank						
SECTION 4						
4 Arrival and landings 4.1 Aerodrome arrival procedure		P---->	---->		M	
4.2 Normal landing		P---->	---->		M	

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
4.3 Flapless landing		P---->	---->		M	
4.4 Crosswind landing (if suitable conditions)		P---->	---->			
4.5 Approach and landing with idle power from up to 2000′ above the runway (single-engine aeroplane only)		P---->	---->			
4.6 Go-around from minimum height		P---->	---->		M	
4.7 Night go-around and landing (if applicable)	P---->	---->	---->			
4.8 ATC liaison – Compliance, R/T procedure						
SECTION 5						
5 Abnormal and emergency procedures (This section may be combined with sections 1 through 4)						
5.1 Rejected take-off at a reasonable speed		P---->	---->		M	
5.2 Simulated engine failure after take-off (single-engine aeroplanes only)			P		M	

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
5.3 Simulated forced landing without power (single-engine aeroplanes only)			P		M	
5.4 Simulated emergencies: (i) fire or smoke in flight, (ii) systems' malfunctions as appropriate	P---->	---->	---->			
5.5 Engine shutdown and restart (ME skill test only) (at a safe altitude if performed in the aircraft)	P---->	---->	---->			
5.6 ATC liaison – Compliance, R/T procedure						
SECTION 6						
6 Simulated asymmetric flight 6.1* (This section may be combined with sections 1 through 5) Simulated engine failure during take-off (at a safe altitude unless carried out in FFS or FNPT II)	P---->	---->	--->X		M	
6.2* Asymmetric approach and go-around	P---->	---->	---->		M	

SINGLE -PILOT AEROPLANES, EXCEPT FOR HIGH PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING				CLASS OR TYPE RATING SKILL TEST/PROF. CHECK	
Manoeuvres/Procedures	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
6.3* Asymmetric approach and full stop landing	P---->	---->	---->		M	
6.4 ATC liaison – Compliance, R/T procedure						

6. Multi-pilot aeroplanes and single-pilot high performance complex aeroplanes:

(a) The following symbols mean:

P = Trained as PIC or Co-pilot and as PF and PNF for the issue of a type rating as applicable.
X = Simulators shall be used for this exercise, if available; otherwise an aircraft shall be used if appropriate for the manoeuvre or procedure.
P# = The training shall be complemented by supervised aeroplane inspection.

(b) The practical training shall be conducted at least at the training equipment level shown as (P), or may be conducted up to any higher equipment level shown by the arrow (——>).

The following abbreviations are used to indicate the training equipment used:
A = Aeroplane
FFS = Full Flight Simulator
FTD = Flight Training Device
OTD = Other Training Devices

(c) The starred items (*) shall be flown solely by reference to instruments. If this condition is not met during the skill test or proficiency check, the type rating will be restricted to VFR only.

(d) Where the letter ‘M’ appears in the skill test or proficiency check column this will indicate the mandatory exercise.

(e) An FFS shall be used for practical training and testing if the FFS forms part of an approved type rating course. The following considerations will apply to the approval of the course:

(i) the qualification of the FFS or FNPT II;

(ii) the qualifications of the instructors;

(iii) the amount of FFS or FNPT II training provided on the course; and

(iv) the qualifications and previous experience on similar types of the pilot under training.

(f) Manoeuvres and procedures shall include MCC for multi-pilot aeroplane and for single-pilot high performance complex aeroplanes in multi-pilot operations.

(g) Manoeuvres and procedures shall be conducted in single-pilot role for single-pilot high performance complex aeroplanes in single-pilot operations.

(h) In the case of single-pilot high performance complex aeroplanes, when a skill test or proficiency check is performed in multi-pilot operations, the type rating shall be restricted to multi-pilot operations. If privileges of single-pilot are sought, the manoeuvres/procedures in 2.5, 3.9.3.4, 4.3, 5.5 and at least one manoeuvre/procedure from section 3.4 have to be completed in addition as single-pilot.

(i) In case of a restricted type rating issued in accordance with FCL.720.A(e), the applicants shall fulfil the same requirements as other applicants for the type rating except for the practical exercises relating to the take-off and landing phases.

(j) To establish or maintain PBN privileges one approach shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
SECTION 1							
1 Flight preparation 1.1 Performance calculation	P						
1.2 Aeroplane external visual inspection; location of each item and purpose of inspection	P#			P			
1.3 Cockpit inspection		P----->	----->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
1.4 Use of checklist prior to starting engines, starting procedures, radio and navigation equipment check, selection and setting of navigation and communication frequencies	P----->	----->	----->	----->		M	
1.5 Taxiing in compliance with air traffic control or instructions of instructor			P----->	----->			
1.6 Before take-off checks		P----->	----->	----->		M	
SECTION 2							
2 Take-offs 2.1 Normal take-offs with different flap settings, including expedited take-off			P----->	----->			
2.2* Instrument take-off; transition to instrument flight is required during rotation or immediately after becoming airborne			P----->	----->			
2.3 Crosswind take-off			P----->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
2.4 Take-off at maximum take-off mass (actual or simulated maximum take-off mass)			P----->	----->			
2.5 Take-offs with simulated engine failure: 2.5.1* shortly after reaching V2			P----->	----->			
(In aeroplanes which are not certificated as transport category or commuter category aeroplanes, the engine failure shall not be simulated until reaching a minimum height of 500 ft above runway end. In aeroplanes having the same performance as a transport category aeroplane regarding take-off mass and density altitude, the instructor may simulate the engine failure shortly after reaching V2)							
2.5.2* between V1 and V2			P	X		M FFS Only	
2.6 Rejected take-off at a reasonable speed before reaching V1			P----->	---->X		M	

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
SECTION 3							
3 Flight Manoeuvres and Procedures 3.1 Turns with and without spoilers			P----->	---->			
3.2 Tuck under and Mach buffets after reaching the critical Mach number, and other specific flight characteristics of the aeroplane (e.g. Dutch Roll)			P----->	---->X An aircraft may not be used for this exercise			
3.3 Normal operation of systems and controls engineer's panel	P----->	----->	----->	----->			
Normal and abnormal operations of following systems:						M	A mandatory minimum of 3 abnormal shall be selected from 3.4.0 to 3.4.14 inclusive

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3.4.0 Engine (if necessary propeller)	P----->	----->	----->	----->			
3.4.1 Pressurisation and air-conditioning	P----->	----->	----->	----->			
3.4.2 Pitot/static system	P----->	----->	----->	----->			
3.4.3 Fuel system	P----->	----->	----->	----->			
3.4.4 Electrical system	P----->	----->	----->	----->			
3.4.5 Hydraulic system	P----->	----->	----->	----->			
3.4.6 Flight control and Trim-system	P----->	----->	----->	----->			
3.4.7 Anti-icing/de-icing system, Glare shield heating	P----->	----->	----->	----->			
3.4.8 Autopilot/Flight director	P----->	----->	----->	----->		M (single pilot Only)	
3.4.9 Stall warning devices or stall avoidance devices, and stability augmentation devices	P----->	----->	----->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3.4.10 Ground proximity warning system, weather radar, radio altimeter, transponder		P----->	----->	----->			
3.4.11 Radios, navigation equipment, instruments, flight management system	P----->	----->	----->	----->			
3.4.12 Landing gear and brake	P----->	----->	----->	----->			
3.4.13 Slat and flap system	P----->	----->	----->	----->			
3.4.14 Auxiliary power unit	P----->	----->	----->	----->			
Intentionally left blank							
3.6 Abnormal and emergency procedures:						M	A mandatory minimum of 3 items shall be selected from 3.6.1 to 3.6.9 inclusive
3.6.1 Fire drills e.g. engine, APU, cabin, cargo compartment, flight deck, wing and electrical fires including evacuation		P----->	----->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3.6.2 Smoke control and removal		P----->	----->	----->			
3.6.3 Engine failures, shutdown and restart at a safe height		P----->	----->	----->			
3.6.4 Fuel dumping (simulated)		P----->	----->	----->			
3.6.5 Wind shear at take-off/landing			P	X		FFS only	
3.6.6 Simulated cabin pressure failure/emergency descent			P----->	----->			
3.6.7 Incapacitation of flight crew member		P----->	----->	----->			
3.6.8 Other emergency procedures as outlined in the appropriate Aeroplane Flight Manual		P----->	----->	----->			
3.6.9 ACAS event	P----->	----->	----->	An aircraft may not be used		FFS only	

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3.7 Steep turns with 45° bank, 180° to 360° left and right		P----->	----->	----->			
3.8 Early recognition and counter measures on approaching stall (up to activation of stall warning device) in take-off configuration (flaps in take-off position), in cruising flight configuration and in landing configuration (flaps in landing position, gear extended) 3.8.1 Recovery from full stall or after activation of stall warning device in climb, cruise and approach configuration			P-----> P	-----> X			
3.9 Instrument flight procedures							
3.9.1* Adherence to departure and arrival routes and ATC instructions		P----->	----->	----->		M	
3.9.2* Holding procedures		P----->	----->	----->			
3.9.3* 3D operations to DH/A of 200 feet (60 m) or to higher minima if required by the approach procedure							

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
Note: According to the AFM, RNP APCH procedures may require the use of autopilot or Flight director. The procedure to be flown manually shall be chosen taking into account such limitations (for example, choose an ILS for 3.9.3.1 in case of such AFM limitation).							
3.9.3.1*manually, without flight director			P----->	----->		M (skill test only)	
3.9.3.2*manually, with flight director			P----->	----->			
3.9.3.3*with autopilot			P----->	----->			
3.9.3.4* manually, with one engine simulated inoperative; engine failure has to be simulated during final approach before passing 1 000 feet above aerodrome level until touchdown or through the complete missed approach procedure In aeroplanes which are not certificated as transport category aeroplanes (JAR/ FAR 25) or as commuter category aeroplanes (SFAR 23), the approach with simulated engine failure and the ensuing go-around shall be initiated in conjunction with the non-precision approach as described			P----->	----->		M	

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
in 3.9.4. The go-around shall be initiated when reaching the published obstacle clearance height (OCH/A), however not later than reaching a minimum descent height/altitude (MDH/A) of 500 feet above runway threshold elevation. In aeroplanes having the same performance as a transport category aeroplane regarding take-off mass and density altitude, the instructor may simulate the engine failure in accordance with 3.9.3.4.							
3.9.4* 2D operations down to the MDH/A			P*--->	----->		M	

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
3.9.5 Circling approach under following conditions: (a)* approach to the authorised minimum circling approach altitude at the aerodrome in question in accordance with the local instrument approach facilities in simulated instrument flight conditions; followed by: (b) circling approach to another runway at least 90° off centreline from final approach used in item (a), at the authorised minimum circling approach altitude. Remark: if (a) and (b) are not possible due to ATC reasons, a simulated low visibility pattern may be performed.			P*--->	----->			
SECTION 4							
4 Missed Approach Procedures 4.1 Go-around with all engines operating* during a 3D operation on reaching decision height			P*--->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
4.2 Other missed approach procedures			P*--->	----->			
4.3* Manual go-around with the critical engine simulated inoperative after an instrument approach on reaching DH, MDH or MAPt			P*----->	----->		M	
4.4 Rejected landing at 15 m (50 ft) above runway threshold and go-around			P----->	----->			
SECTION 5							
5 Landings 5.1 Normal landings* with visual reference established when reaching DA/H following an instrument approach operation			P				
5.2 Landing with simulated jammed horizontal stabiliser in any out-of-trim position			P----->	An aircraft may not be used for this exercise			
5.3 Crosswind landings (a/c, if practicable)			P----->	----->			

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
5.4 Traffic pattern and landing without extended or with partly extended flaps and slats			P----->	----->			
5.5 Landing with critical engine simulated inoperative			P----->	----->		M	
5.6 Landing with two engines inoperative: - aeroplanes with 3 engines: the centre engine and 1 outboard engine as far as practicable according to data of the AFM; - aeroplanes with 4 engines: 2 engines at one side			P	X		M FFS only (skill test only)	
General remarks: Special requirements for extension of a type rating for instrument approaches down to a decision height of less than 200 feet (60 m), i.e. Cat II/III operations.							
SECTION 6							

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
Additional authorisation on a type rating for instrument approaches down to a decision height of less than 60 m (200 ft) (CAT II/III) The following manoeuvres and procedures are the minimum training requirements to permit instrument approaches down to a DH of less than 60 m (200 ft). During the following instrument approaches and missed approach procedures all aeroplane equipment required for type certification of instrument approaches down to a DH of less than 60m (200ft) shall be used.							
6.1* Rejected take-off at minimum authorised RVR			P*----->	---->X An aircraft may not be used for this exercise		M*	

MULTI-PILOT AEROPLANES AND SINGLE-PILOT HIGH-PERFORMANCE COMPLEX AEROPLANES	PRACTICAL TRAINING					ATPL/MPL/TYPE RATING SKILL TEST OR PROF. CHECK	
Manoeuvres/Procedures	OTD	FTD	FFS	A	Instructor initials when training completed	Chkd in FFS A	Examiner initials when test completed
6.2* CAT II/III approaches: in simulated instrument flight conditions down to the applicable DH, using flight guidance system. Standard procedures of crew coordination (task sharing, call out procedures, mutual surveillance, information exchange and support) shall be observed			P----->	----->		M	
6.3* Go-around: after approaches as indicated in 6.2 on reaching DH. The training shall also include a go-around due to (simulated) insufficient RVR, wind shear, aeroplane deviation in excess of approach limits for a successful approach, and ground/airborne equipment failure prior to reaching DH and, go-around with simulated airborne equipment failure			P----->	----->		M*	
6.4* Landing(s): with visual reference established at DH following an instrument approach. Depending on the specific flight guidance system, an automatic landing shall be performed			P----->	----->		M	

Note: CAT II/III operations shall be accomplished in accordance with the applicable air operations requirements.

7. Class ratings — sea.

Section 6 shall be completed to revalidate a multi-engine class rating sea, VFR only, where the required experience of 10 route sectors within the previous 12 months has not been completed.

CLASS RATING SEA	PRACTICAL TRAINING	
Manoeuvres/Procedures	Instructor's initials when training completed	Examiner's initials when test completed
SECTION 1		
1. **Departure** 1.1 Pre-flight including: Documentation Mass and Balance Weather briefing NOTAM		
1.2 Pre-start checks External/internal		
1.3 Engine start-up and shutdown Normal malfunctions		
1.4 Taxiing		
1.5 Step taxiing		
1.6 Mooring: Beach Jetty pier Buoy		
1.7 Engine-off sailing		
1.8 Pre-departure checks: Engine run-up (if applicable)		
1.9 Take-off procedure: Normal with Flight Manual flap settings Crosswind (if conditions available)		
1.10 Climbing Turns onto headings Level off		
CLASS RATING SEA	PRACTICAL TRAINING	
Manoeuvres/Procedures	Instructor's initials when training completed	Examiner's initials when test completed
1.11 ATC liaison — Compliance, R/T procedure		
SECTION 2		
2. **Airwork (VFR)** 2.1 Straight and level flight at various airspeeds including flight at critically low airspeed with and without flaps (including approach to VMCA when applicable)		

2.2 Steep turns (360° left and right at 45° bank)		
2.3 Stalls and recovery: (i) clean stall; (ii) approach to stall in descending turn with bank with approach configuration and power; (iii) approach to stall in landing configuration and power; (iv) approach to stall, climbing turn with take-off flap and climb power (single-engine aeroplane only)		
2.4 ATC liaison — Compliance, R/T procedure		
SECTION 3		
3. **En-route procedures VFR** 3.1 Flight plan, dead reckoning and map reading		
3.2 Maintenance of altitude, heading and speed		
3.3 Orientation, timing and revision of ETAs		
3.4 Use of radio navigation aids (if applicable)		
3.5 Flight management (flight log, routine checks including fuel, systems and icing)		
3.6 ATC liaison — Compliance, R/T procedure		
SECTION 4		
4. **Arrivals and landings** 4.1 Aerodrome arrival procedure (amphibians only)		
4.2 Normal landing		
4.3 Flapless landing		
4.4 Crosswind landing (if suitable conditions)		
4.5 Approach and landing with idle power from up to 2 000' above the water (single-engine aeroplane only)		
CLASS RATING SEA	PRACTICAL TRAINING	
Manoeuvres/Procedures	Instructor's initials when training completed	Examiner's initials when test completed
4.6 Go-around from minimum height		

4.7 Glassy water landing Rough water landing		
4.8 ATC liaison — Compliance, R/T procedure		
SECTION 5		
5. **Abnormal and emergency procedures** (This section may be combined with sections 1 through 4) 5.1 Rejected take-off at a reasonable speed		
5.2 Simulated engine failure after take-off (single-engine aeroplane only)		
5.3 Simulated forced landing without power (single-engine aeroplane only)		
5.4 Simulated emergencies: (i) fire or smoke in flight; (ii) systems' malfunctions as appropriate		
5.5 ATC liaison — Compliance, R/T procedure		
SECTION 6		
6. **Simulated asymmetric flight** (This section may be combined with sections 1 through 5) 6.1 Simulated engine failure during take-off (at a safe altitude unless carried out in FFS and FNPT II)		
6.2 Engine shutdown and restart (ME skill test only)		
6.3 Asymmetric approach and go- around		
6.4 Asymmetric approach and full stop landing		
6.5 ATC liaison — Compliance, R/T procedure		

C. **Specific requirements for the helicopter category**

1. In case of skill test or proficiency check for type ratings and the ATPL the applicant shall pass sections 1 to 4 and 6 (as applicable) of the skill test or proficiency check. Failure in more than five items will require the applicant to take the entire test or check again. An applicant failing not more than five items shall take the failed items again. Failure in any item of the re-test or re- check or

failure in any other items already passed will require the applicant to take the entire test or check again. All sections of the skill test or proficiency check shall be completed within 6 months.

2. In case of proficiency check for an IR the applicant shall pass section 5 of the proficiency check. Failure in more than three items will require the applicant to take the entire section 5 again. An applicant failing not more than three items shall take the failed items again. Failure in any item of the re-check or failure in any other items of section 5 already passed will require the applicant to take the entire check again.

FLIGHT TEST TOLERANCE

3. The applicant shall demonstrate the ability to:

(a) operate the helicopter within its limitations;

(b) complete all manoeuvres with smoothness and accuracy;

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge;

(e) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never in doubt;

(f) understand and apply crew coordination and incapacitation procedures, if applicable; and

(g) communicate effectively with the other crew members, if applicable.

4. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the helicopter used.

(a) IFR flight limits

Height:

Generally	± 100 feet
Starting a go-around at decision height/altitude	+ 50 feet/– 0 feet
Minimum descent height/MAP/altitude	+ 50 feet/– 0 feet

Tracking:

On radio aids	± 5°
For “angular” deviations	Half scale deflection, azimuth and glide path (e.g. LPV, ILS, MLS, GLS)
2D (LNAV) and 3D (LNAV/VNAV) “linear” lateral deviations	cross-track error/deviation shall normally be limited to ± ½ the RNP value associated with the procedure. Brief deviations from this standard up to a maximum of 1 time the RNP value are allowable.
3D linear vertical deviations (e.g. RNP APCH (LNAV/VNAV) using BaroVNAV)	not more than – 75 feet below the vertical profile at any time, and not more than + 75 feet

	above the vertical profile at or below 1 000 feet above aerodrome level.
Heading:	
all engines operating	± 5°
with simulated engine failure	± 10°
Speed:	
all engines operating	± 5 knots
With simulated engine failure	+ 10 knots/– 5 knots

(b) VFR flight limits

Height:	
Generally	± 100 feet
Heading:	
Normal operations	± 5°
Abnormal operations/emergencies	± 10°
Speed:	
Generally	± 10 knots
With simulated engine failure	+ 10 knots/– 5 knots
Ground drift:	
T.O. hover I.G.E.	± 3 feet
Landing	± 2 feet (with 0 feet rearward or lateral flight)

CONTENT OF THE TRAINING/SKILL TEST/PROFICIENCY CHECK

GENERAL

5. The following symbols mean:

P = Trained as PIC for the issue of a type rating for SPH or trained as PIC or Co-pilot and as PF and PNF for the issue of a type rating for MPH.

6. The practical training shall be conducted at least at the training equipment level shown as (P), or may be conducted up to any higher equipment level shown by the arrow (—>).

The following abbreviations are used to indicate the training equipment used:

FFS = Full Flight Simulator

FTD = Flight Training Device

H = Helicopter

7. The starred items (*) shall be flown in actual or simulated IMC, only by applicants wishing to renew or revalidate an IR(H), or extend the privileges of that rating to another type.

8. Instrument flight procedures (section 5) shall be performed only by applicants wishing to renew or revalidate an IR(H) or extend the privileges of that rating to another type. An FFS or FTD 2/3 may be used for this purpose.

9. Where the letter 'M' appears in the skill test or proficiency check column this will indicate the mandatory exercise.

10. An FSTD shall be used for practical training and testing if the FSTD forms part of a type rating course. The following considerations will apply to the course:

(i) the qualification of the FSTD as set out in the relevant requirements of Part-ARA and Part-ORA;

(ii) the qualifications of the instructor and examiner;

(iii) the amount of FSTD training provided on the course;

(iv) the qualifications and previous experience in similar types of the pilot under training; and

(v) the amount of supervised flying experience provided after the issue of the new type rating.

MULTI-PILOT HELICOPTERS

11. Applicants for the skill test for the issue of the multi-pilot helicopter type rating and ATPL(H) shall take only sections 1 to 4 and, if applicable, section 6.

12. Applicants for the revalidation or renewal of the multi-pilot helicopter type rating proficiency check shall take only sections 1 to 4 and, if applicable, section 6.

SINGLE/MULTI-PILOT HELICOPTERS		PRACTICAL TRAINING				SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		FTD	FFS	H	Instructor initials when training completed	Chkd in FFS H	Examiner initials when test completed
SECTION 1 — Pre-flight preparations and checks							
1.1	Helicopter exterior visual inspection; location of each item and purpose of inspection			P		M (if performed in the helicopter)	

SINGLE/MULTI-PILOT HELICOPTERS		PRACTICAL TRAINING				SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		FTD	FFS	H	Instructor initials when training completed	Chkd in FFS H	Examiner initials when test completed
1.2	Cockpit inspection		P	---->		M	
1.3	Starting procedures, radio and navigation equipment check, selection and setting of navigation and communication frequencies	P	---->	---->		M	
1.4	Taxiing/air taxiing in compliance with air traffic control instructions or with instructions of an instructor		P	---->		M	
1.5	Pre-take-off procedures and checks	P	---->	---->		M	
SECTION 2 — Flight manoeuvres and procedures							
2.1	Take-offs (various profiles)		P	---->		M	
2.2	Sloping ground or crosswind take-offs & landings		P	---->			
2.3	Take-off at maximum take-off mass (actual or simulated maximum take-off mass)	P	---->	---->			
2.4	Take-off with simulated engine failure shortly before reaching TDP or DPATO		P	---->		M	

SINGLE/MULTI-PILOT HELICOPTERS		PRACTICAL TRAINING				SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		FTD	FFS	H	Instructor initials when training completed	Chkd in FFS H	Examiner initials when test completed
2.4.1	Take-off with simulated engine failure shortly after reaching TDP or DPATO		P	---->		M	
2.5	Climbing and descending turns to specified headings	P	---->	---->		M	
2.5.1	Turns with 30° bank, 180°to 360° left and right, by sole reference to instruments	P	---->	---->		M	
2.6	Autorotative descent	P	---->	---->		M	
2.6.1	Autorotative landing (SEH only) or power recovery		P	---->		M	
2.7	Landings, various profiles		P	---->		M	
2.7.1	Go-around or landing following simulated engine failure before LDP or DPBL		P	---->		M	
2.7.2	Landing following simulated engine failure after LDP or DPBL		P	---->		M	
SECTION 3 — Normal and abnormal operations of the following systems and procedures							

SINGLE/MULTI-PILOT HELICOPTERS		PRACTICAL TRAINING				SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		FTD	FFS	H	Instructor initials when training completed	Chkd in FFS H	Examiner initials when test completed
3	Normal and abnormal operations of the following systems and procedures:					M	A mandatory minimum of 3 items shall be selected from this section
3.1	Engine	P	---->	---->			
3.2	Air conditioning (heating, ventilation)	P	---->	---->			
3.3	Pitot/static system	P	---->	---->			
3.4	Fuel System	P	---->	---->			
3.5	Electrical system	P	---->	---->			
3.6	Hydraulic system	P	---->	---->			
3.7	Flight control and Trim system	P	---->	---->			
3.8	Anti-icing and de-icing system	P	---->	---->			
3.9	Autopilot/Flight director	P	--->	--->			
3.10	Stability augmentation devices	P	---->	---->			
3.11	Weather radar, radio altimeter, transponder	P	---->	---->			

SINGLE/MULTI-PILOT HELICOPTERS		PRACTICAL TRAINING				SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		FTD	FFS	H	Instructor initials when training completed	Chkd in FFS H	Examiner initials when test completed
3.12	Area Navigation System	P	---->	---->			
3.13	Landing gear system	P	----->	----->			
3.14	Auxiliary power unit	P	---->	---->			
3.15	Radio, navigation equipment, instruments flight management system	P	---->	---->			
SECTION 4 — Abnormal and emergency procedures							
4	Abnormal and emergency procedures					M	A mandatory minimum of 3 items shall be selected from this section
4.1	Fire drills (including evacuation if applicable)	P	---->	---->			
4.2	Smoke control and removal	P	---->	---->			
4.3	Engine failures, shutdown and restart at a safe height	P	---->	---->			
4.4	Fuel dumping (simulated)	P	---->	---->			

4.5	Tail rotor control failure (if applicable)	P	---->	---->			
4.5.1	Tail rotor loss (if applicable)	P	---->	Helicopter may not be used for this exercise			
4.6	Incapacitation of crew member – MPH only	P	---->	---->			
4.7	Transmission malfunctions	P	---->	---->			
4.8	Other emergency procedures as outlined in the appropriate Flight Manual	P	---->	---->			
SECTION 5 — Instrument Flight Procedures (to be performed in IMC or simulated IMC)							
5.1	Instrument take-off: transition to instrument flight is required as soon as possible after becoming airborne	P*	---->*	---->*			
5.1.1	Simulated engine failure during departure	P*	---->*	---->*		M*	
5.2	Adherence to departure and arrival routes and ATC instructions	P*	---->*	---->*		M*	
5.3	Holding procedures	P*	---->*	---->*			
5.4	3D operations to DH/A of 200 feet (60 m) or to higher minima if required by the approach procedure	P*	---->*	---->*			

5.4.1	Manually, without flight director. Note: According to the AFM, RNP APCH procedures may require the use of autopilot or Flight director. The procedure to be flown manually shall be chosen taken into account such limitations (example choose an ILS for 5.4.1 in case of such AFM limitation)	P*	---->*	---->*		M*	
5.4.2	Manually, with Flight Director	P*	---->*	---->*		M*	
5.4.3	With coupled autopilot	P*	---->*	---->*			
5.4.4	Manually, with one engine simulated inoperative; engine failure has to be simulated during final approach before passing 1000 feet above aerodrome level until touchdown or until completion of the missed approach procedure	P*	---->*	---->*		M*	
5.5	2D operations down to the minimum descent altitude MDA/H	P*	---->*	---->*		M*	
5.6	Go-around with all engines operating on reaching DA/DH or MDA/MDH	P*	---->*	---->*			
5.6.1	Other missed approach procedures	P*	---->*	---->*			
5.6.2	Go-around with one engine simulated inoperative on reaching DA/DH or MDA/MDH	P*				M*	

5.7	IMC autorotation with power recovery	P*	---->*	---->*		M*	
5.8	Recovery from unusual attitudes	P*	---->*	---->*		M*	
SECTION 6 — Use of Optional Equipment							
6	Use of optional equipment	P	---->	---->			

D. **Specific requirements for the powered-lift aircraft category**

1. In the case of skill tests or proficiency checks for powered-lift aircraft type ratings, the applicant shall pass sections 1 to 5 and 6 (as applicable) of the skill test or proficiency check. Failure in more than five items will require the applicant to take the entire test or check again. An applicant failing not more than five items shall take the failed items again. Failure in any item of the re- test or re-check or failure in any other items already passed will require the applicant to take the entire test or check again. All sections of the skill test or proficiency check shall be completed within 6 months.

FLIGHT TEST TOLERANCE

2. The applicant shall demonstrate the ability to:

(a) operate the powered-lift aircraft within its limitations;

(b) complete all manoeuvres with smoothness and accuracy;

(c) exercise good judgement and airmanship;

(d) apply aeronautical knowledge;

(e) maintain control of the powered-lift aircraft at all times in such a manner that the successful outcome of a procedure or manoeuvre is never in doubt;

(f) understand and apply crew coordination and incapacitation procedures; and

(g) communicate effectively with the other crew members.

3. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the powered-lift aircraft used.

(a) IFR flight limits:

Height:

Generally	± 100 feet
Starting a go-around at decision height/altitude	+ 50 feet/– 0 feet
Minimum descent height/altitude	+ 50 feet/– 0 feet

Tracking:

On radio aids	± 5°
Precision approach	half scale deflection, azimuth and glide path

Heading:

Normal operations	± 5°
Abnormal operations/emergencies	± 10°

Speed:

Generally	± 10 knots
With simulated engine failure	+ 10 knots/– 5 knots

(b) VFR flight limits:

Height:

Generally	± 100 feet

Heading:

Normal operations	± 5°
Abnormal operations/emergencies	± 10°

Speed:

Generally	± 10 knots
With simulated engine failure	+ 10 knots/– 5 knots

Ground drift:

T.O. hover I.G.E.	± 3 feet
Landing	± 2 feet (with 0 feet rearward or lateral flight)

CONTENT OF THE TRAINING/SKILL TEST/PROFICIENCY CHECK

4. The following symbols mean:

P = Trained as PIC or Co-pilot and as PF and PNF for the issue of a type rating as applicable.

5. The practical training shall be conducted at least at the training equipment level shown as (P), or may be conducted up to any higher equipment level shown by the arrow (—>).

6. The following abbreviations are used to indicate the training equipment used:

FFS = Full Flight Simulator

FTD = Flight Training Device

OTD = Other Training Device

PL = Powered-lift aircraft

(a) Applicants for the skill test for the issue of the powered-lift aircraft type rating shall take sections 1 to 5 and, if applicable, section 6.

(b) Applicants for the revalidation or renewal of the powered-lift aircraft type rating proficiency check shall take sections 1 to 5 and, if applicable section 6 and/or 7.

(c) The starred items (*) shall be flown solely by reference to instruments. If this condition is not met during the skill test or proficiency check, the type rating will be restricted to VFR only.

7. Where the letter 'M' appears in the skill test or proficiency check column this will indicate the mandatory exercise.

8. Flight Simulation Training Devices shall be used for practical training and testing if they form part of an approved type rating course. The following considerations will apply to the approval of the course:

(a) the qualification of the flight simulation training devices as set out in the relevant requirements of Part-ARA and Part-ORA;

(b) the qualifications of the instructor.

POWERED-LIFT AIRCRAFT CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	PL	Instructor's initials when training completed	Chkd in FFS PL	Examiner's initials when test completed
SECTION 1 — Pre-flight preparations and checks								
1.1	Powered-lift aircraft exterior visual inspection; location of each item and purpose of inspection				P			
1.2	Cockpit inspection	P	---->	---->	---->			
1.3	Starting procedures, radio and navigation equipment check, selection and setting of navigation and communication frequencies	P	---->	---->	---->		M	

POWERED-LIFT AIRCRAFT CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	PL	Instructor's initials when training completed	Chkd in FFS PL	Examiner's initials when test completed
1.4	Taxiing in compliance with air traffic control instructions or with instructions of an instructor		P	---->	---->			
1.5	Pre-take-off procedures and checks including Power Check	P	---->	---->	---->		M	
SECTION 2 — Flight manoeuvres and procedures								
2.1	Normal VFR take-off profiles; Runway operations (STOL and VTOL) including crosswind Elevated heliports Ground level heliports		P	---->	---->		M	
2.2	Take-off at maximum take-off mass (actual or simulated maximum take-off mass)		P	---->				
2.3.1	Rejected take-off: during runway operations during elevated heliport operations during ground level operations		P	---->			M	

2.3.2	Take-off with simulated engine failure after passing decision point: during runway operations during elevated heliport operations during ground level operations		P	---->			M	
2.4	Autorotative descent in helicopter mode to ground (an aircraft shall not be used for this exercise)	P	---->	---->			M FFS only	
2.4.1	Windmill descent in aeroplane mode (an aircraft shall not be used for this exercise)		P	---->			M FFS only	
2.5	Normal VFR landing profiles; runway operations (STOL and VTOL) elevated heliports ground level heliports		P	---->	---->		M	
2.5.1	Landing with simulated engine failure after reaching decision point: during runway operations during elevated heliport operations during ground level operations							
2.6	Go-around or landing following simulated engine failure before decision point		P	---->			M	

SECTION 3 — Normal and abnormal operations of the following systems and procedures:								
3	Normal and abnormal operations of the following systems and procedures (may be completed in an FSTD if qualified for the exercise):						M	A mandatory minimum of 3 items shall be selected from this section
3.1	Engine	P	---->	---->				
3.2	Pressurisation and air conditioning (heating, ventilation)	P	---->	---->				
3.3	Pitot/static system	P	---->	---->				
3.4	Fuel System	P	---->	---->				
3.5	Electrical system	P	---->	---->				
3.6	Hydraulic system	P	---->	---->				
3.7	Flight control and Trim-system	P	---->	---->				
3.8	Anti-icing and de-icing system, glare shield heating (if fitted)	P	---->	---->				
3.9	Autopilot/Flight director	P	--->	--->				
3.10	Stall warning devices or stall avoidance devices and stability augmentation devices	P	---->	---->				
3.11	Weather radar, radio altimeter, transponder, ground proximity warning system (if fitted)	P	---->	---->				

3.12	Landing gear system	P	----->	----->				
3.13	Auxiliary power unit	P	---->	---->				
3.14	Radio, navigation equipment, instruments and flight management system	P	---->	---->				
3.15	Flap system	P	---->	---->				
SECTION 4 — Abnormal and emergency procedures								
4	Abnormal and emergency procedures (may be completed in an FSTD if qualified for the exercise)						M	A mandatory minimum of 3 items shall be selected from this section
4.1	Fire drills, engine, APU, cargo compartment, flight deck and electrical fires including evacuation if applicable	P	---->	---->				
4.2	Smoke control and removal	P	---->	---->				
4.3	Engine failures, shutdown and restart (an aircraft shall not be used for this exercise) including OEI conversion from helicopter to aeroplane modes and vice versa	P	---->	---->			FFS only	
4.4	Fuel dumping (simulated, if fitted)	P	---->	---->				

4.5	Wind shear at take-off and landing (an aircraft shall not be used for this exercise)			P			FFS only	
4.6	Simulated cabin pressure failure/emergency descent (an aircraft shall not be used for this exercise)	P	---->	---->			FFS only	
4.7	ACAS event (an aircraft shall not be used for this exercise)	P	---->	---->			FFS only	
4.8	Incapacitation of crew member	P	---->	---->				
4.9	Transmission malfunctions	P	---->	---->			FFS only	
4.10	Recovery from a full stall (power on and off) or after activation of stall warning devices in climb, cruise and approach configurations (an aircraft shall not be used for this exercise)	P	---->	---->			FFS only	
4.11	Other emergency procedures as detailed in the appropriate Flight Manual	P	---->	---->				
SECTION 5 — Instrument Flight Procedures (to be performed in IMC or simulated IMC)								

5.1	Instrument take-off: transition to instrument flight is required as soon as possible after becoming airborne	P*	---->*	---->*				
5.1.1	Simulated engine failure during departure after decision point	P*	---->*	---->*			M*	
5.2	Adherence to departure and arrival routes and ATC instructions	P*	---->*	---->*			M*	
5.3	Holding procedures	P*	---->*	---->*				
5.4	Precision approach down to a decision height not less than 60 m (200 ft)	P*	---->*	---->*				
5.4.1	Manually, without flight director	P*	---->*	---->*			M* (Skill test only)	
5.4.2	Manually, with flight director	P*	---->*	---->*				
5.4.3	With use of autopilot	P*	---->*	---->*				
5.4.4	Manually, with one engine simulated inoperative; engine failure has to be simulated during final approach before passing the outer marker (OM) and continued either to touchdown, or through to the completion of the missed approach procedure)	P*	---->*	---->*			M*	

5.5	Non-precision approach down to the minimum descent altitude MDA/H	P*	---->*	---->*			M*	
5.6	Go-around with all engines operating on reaching DA/DH or MDA/MDH	P*	---->*	---->*				
5.6.1	Other missed approach procedures	P*	---->*	---->*				
5.6.2	Go-around with one engine simulated inoperative on reaching DA/DH or MDA/MDH	P*					M*	
5.7	IMC autorotation with power recovery to land on runway in helicopter mode only (an aircraft shall not be used for this exercise)	P*	---->*	---->*			M* FFS only	
5.8	Recovery from unusual attitudes (this one depends on the quality of the FFS)	P*	---->*	---->*			M*	

SECTION 6 — Additional authorisation on a type rating for instrument approaches down to a decision height of less than 60 m (CAT II/III)

6	Additional authorisation on a type rating for instrument approaches down to a decision height of less than 60 m (CAT II/III). The following manoeuvres and procedures are the minimum training requirements to permit instrument approaches down to a DH of less than 60 m (200 ft). During the following instrument approaches and missed approach procedures all powered-lift aircraft equipment required for the type certification of instrument approaches down to a DH of less than 60 m (200 ft) shall be used							
6.1	Rejected take-off at minimum authorised RVR		P	---->			M*	
6.2	ILS approaches in simulated instrument flight conditions down to the applicable DH, using flight guidance system. Standard procedures of crew coordination (SOPs) shall be observed		P	---->	---->		M*	

6.3	Go-around after approaches as indicated in 6.2 on reaching DH. The training shall also include a go-around due to (simulated) insufficient RVR, wind shear, aircraft deviation in excess of approach limits for a successful approach, ground/airborne equipment failure prior to reaching DH, and go-around with simulated airborne equipment failure		P	---->	---->		M*	
6.4	Landing(s) with visual reference established at DH following an instrument approach. Depending on the specific flight guidance system, an automatic landing shall be performed		P	---->			M*	
Section 7 Optional equipment								
7	Use of optional equipment		P	---->	---->			

E. **Specific requirements for the airship category**

1. In the case of skill tests or proficiency checks for airship type ratings the applicant shall pass sections 1 to 5 and 6 (as applicable) of the skill test or proficiency check. Failure in more than five items will require the applicant to take the entire test/check again. An applicant failing not more than five items shall take the failed items again. Failure in any item of the re-test/re- check or failure in any other items already passed will require the applicant to take the entire test/check again. All sections of the skill test or proficiency check shall be completed within 6 months.

FLIGHT TEST TOLERANCE

2. The applicant shall demonstrate the ability to:

(i) operate the airship within its limitations;

(ii) complete all manoeuvres with smoothness and accuracy;

(iii) exercise good judgement and airmanship;

(iv) apply aeronautical knowledge;

(v) maintain control of the airship at all times in such a manner that the successful outcome of a procedure or manoeuvre is never in doubt;

(vi) understand and apply crew coordination and incapacitation procedures; and

(vii) communicate effectively with the other crew members.

3. The following limits shall apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the airship used.

(a) IFR flight limits:

Height:	
Generally	± 100 feet
Starting a go-around at decision height/altitude	+ 50 feet/– 0 feet
Minimum descent height/altitude	+ 50 feet/– 0 feet
Tracking:	
On radio aids	± 5°
Precision approach	half scale deflection, azimuth and glide path
Heading:	
Normal operations	± 5°
Abnormal operations/emergencies	± 10°

(b) VFR flight limits:

Height:	
Generally	± 100 feet
Heading:	
Normal operations	± 5°
Abnormal operations/emergencies	± 10°

CONTENT OF THE TRAINING/SKILL TEST/PROFICIENCY CHECK

4. The following symbols mean:

P = Trained as PIC or Co-pilot and as PF and PNF for the issue of a type rating as applicable.

5. The practical training shall be conducted at least at the training equipment level shown as (P), or may be conducted up to any higher equipment level shown by the arrow (—>).

6. The following abbreviations are used to indicate the training equipment used:

FFS = Full Flight Simulator

FTD = Flight Training Device

OTD = Other Training Device

As = Airship

(a) Applicants for the skill test for the issue of the airship shall take sections 1 to 5 and, if applicable, section 6.

(b) Applicants for the revalidation or renewal of the airship type rating proficiency check shall take sections 1 to 5 and, if applicable section 6.

(c) The starred items (*) shall be flown solely by reference to instruments. If this condition is not met during the skill test or proficiency check, the type rating will be restricted to VFR only.

7. Where the letter 'M' appears in the skill test or proficiency check column this will indicate the mandatory exercise.

8. Flight Simulation Training Devices shall be used for practical training and testing if they form part of a type rating course. The following considerations will apply to the course:

(a) the qualification of the flight simulation training devices as set out in the relevant requirements of Part-ARA and Part-ORA;

(b) the qualifications of the instructor.

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
SECTION 1 — Pre-flight preparations and checks								
1.1	Pre-flight inspection				P			
1.2	Cockpit inspection	P	---->	---->	---->			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
1.3	Starting procedures, radio and navigation equipment check, selection and setting of navigation and communication frequencies		P	---->	---->		M	
1.4	Off Mast procedure and Ground Manoeuvring			P	---->		M	
1.5	Pre-take-off procedures and checks	P	---->	---->	---->		M	
SECTION 2 — Flight manoeuvres and procedures								
2.1	Normal VFR take-off profile			P	---->		M	
2.2	Take-off with simulated engine failure			P	---->		M	
2.3	Take-off with heaviness > 0 (Heavy T/O)			P	---->			
2.4	Take-off with heaviness < 0 (Light/TO)			P	---->			
2.5	Normal climb procedure			P	---->			
2.6	Climb to Pressure Height			P	---->			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
2.7	Recognising of Pressure Height			P	---->			
2.8	Flight at or close to Pressure Height			P	---->		M	
2.9	Normal descent and approach			P	---->			
2.10	Normal VFR landing profile			P	---->		M	
2.11	Landing with heaviness > 0 (Heavy Ldg.)			P	---->		M	
2.12	Landing with heaviness < 0 (Light Ldg.)			P	---->		M	
	Intentionally left blank							
SECTION 3 — Normal and abnormal operations of the following systems and procedures								
3	Normal and abnormal operations of the following systems and procedures (may be completed in an FSTD if qualified for the exercise):						M	A mandatory minimum of 3 items shall be selected from this section
3.1	Engine	P	---->	---->	---->			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
3.2	Envelope Pressurisation	P	---->	---->	---->			
3.3	Pitot/static system	P	---->	---->	---->			
3.4	Fuel system	P	---->	---->	---->			
3.5	Electrical system	P	---->	---->	---->			
3.6	Hydraulic system	P	---->	---->	---->			
3.7	Flight control and Trim-system	P	---->	---->	---->			
3.8	Ballonet system	P	---->	---->	---->			
3.9	Autopilot/Flight director	P	--->	--->	---->			
3.10	Stability augmentation devices	P	---->	---->	---->			
3.11	Weather radar, radio altimeter, transponder, ground proximity warning system (if fitted)	P	---->	---->	---->			
3.12	Landing gear system	P	----->	----->	---->			
3.13	Auxiliary power unit	P	---->	---->	---->			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
3.14	Radio, navigation equipment, instruments and flight management system	P	---->	---->	---->			
	Intentionally left blank							
SECTION 4 — Abnormal and emergency procedures								
4	Abnormal and emergency procedures (may be completed in an FSTD if qualified for the exercise)						M	A mandatory minimum of three items shall be selected from this section
4.1	Fire drills, engine, APU, cargo compartment, flight deck and electrical fires including evacuation if applicable	P	---->	---->	---->			
4.2	Smoke control and removal	P	---->	---->	---->			
4.3	Engine failures, shutdown and restart In particular phases of flight, inclusive multiple engine failure	P	---->	---->	---->			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
4.4	Incapacitation of crew member	P	---->	---->	---->			
4.5	Transmission/Gearbox malfunctions	P	---->	---->	---->		FFS only	
4.6	Other emergency procedures as outlined in the appropriate Flight Manual	P	---->	---->	---->			
SECTION 5 — Instrument Flight Procedures (to be performed in IMC or simulated IMC)								
5.1	Instrument take-off: transition to instrument flight is required as soon as possible after becoming airborne	P*	---->*	---->*	---->*			
5.1.1	Simulated engine failure during departure	P*	---->*	---->*	---->*		M*	
5.2	Adherence to departure and arrival routes and ATC instructions	P*	---->*	---->*	---->*		M*	
5.3	Holding procedures	P*	---->*	---->*	---->*			
5.4	Precision approach down to a decision height not less than 60 m (200 ft)	P*	---->*	---->*	---->*			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
5.4.1	Manually, without flight director	P*	---->*	---->*	---->*		M* (Skill test only)	
5.4.2	Manually, with flight director	P*	---->*	---->*	---->*			
5.4.3	With use of autopilot	P*	---->*	---->*	---->*			
5.4.4	Manually, with one engine simulated inoperative; engine failure has to be simulated during final approach before passing the outer marker (OM) and continued to touchdown, or until completion of the missed approach procedure	P*	---->*	---->*	---->*		M*	
5.5	Non-precision approach down to the minimum descent altitude MDA/H	P*	---->*	---->*	---->*		M*	
5.6	Go-around with all engines operating on reaching DA/DH or MDA/MDH	P*	---->*	---->*	---->*			
5.6.1	Other missed approach procedures	P*	---->*	---->*	---->*			

AIRSHIP CATEGORY		PRACTICAL TRAINING					SKILL TEST OR PROFICIENCY CHECK	
Manoeuvres/Procedures		OTD	FTD	FFS	As	Instructor's initials when training completed	Chkd in FFS As	Examiner's initials when test completed
5.6.2	Go-around with one engine simulated inoperative on reaching DA/DH or MDA/MDH	P*					M*	
5.7	Recovery from unusual attitudes (this one depends on the quality of the FFS)	P*	---->*	---->*	---->*		M*	

SECTION 6 — Additional authorisation on a type rating for instrument approaches down to a decision height of less than 60 m (CAT II/III)								
6	Additional authorisation on a type rating for instrument approaches down to a decision height of less than 60 m (CAT II/III). The following manoeuvres and procedures are the minimum training requirements to permit instrument approaches down to a DH of less than 60 m (200 ft). During the following instrument approaches and missed approach procedures all airship equipment required for the type certification of instrument approaches down to a DH of less than 60 m (200 ft) shall be used.							

6.1	Rejected take-off at minimum authorised RVR		P	---->			M*	
6.2	ILS approaches In simulated instrument flight conditions down to the applicable DH, using flight guidance system. Standard procedures of crew coordination (SOPs) shall be observed		P	---->			M*	
6.3	Go-around After approaches as indicated in 6.2 on reaching DH. The training shall also include a go-around due to (simulated) insufficient RVR, wind shear, aircraft deviation in excess of approach limits for a successful approach, and ground/airborne equipment failure prior to reaching DH and, go-around with simulated airborne equipment failure		P	---->			M*	
6.4	Landing(s) With visual reference established at DH following an instrument approach. Depending on the specific flight guidance system, an automatic landing shall be performed		P	---->			M*	
SECTION 7 — Optional equipment								
7	Use of optional equipment		P	---->				

AMC1 to Appendix 9 Training, skill test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

APPLICATION AND REPORT FORM

If applicable, this form is also the certificate of completion of the type rating course for ZFTT.

APPLICATION AND REPORT FORM ATPL, MPL, TYPE RATING, TRAINING, SKILL TEST AND PROFICIENCY CHECK AEROPLANES (A) AND HELICOPTERS (H)			
Applicant's last name(s):	**Aircraft:**	**SE-SP: A ☐ H ☐**	**ME-SP: A ☐ H ☐**
Applicant's first name(s):		**SE-MP: A ☐ H ☐**	**ME-MP: A ☐ H ☐**
Signature of applicant:	**Operations:**	**SP ☐**	**MP ☐**
Type of licence held:	**Checklist:**	**Training record: ☐**	**Type rating: ☐**
Licence number:		**Skill test: ☐**	**Class rating: ☐**
		IR: ☐	
State of licence issue:		**Proficiency check: ☐**	**ATPL: ☐ MPL: ☐**

1	**Theoretical training for the issue of a type or class rating performed during period**		
From:	**To:**	**At:**	
Mark obtained:	**% (Pass mark 75%):**	**Type and number of licence:**	
Signature of HT:		**Name(s) in capital letters:**	
2	**FSTD**		
FSTD (aircraft type):	**Three or more axes: Yes ☐ No ☐**	**Ready for service and used:**	
FSTD manufacturer:	**Motion or system:**	**Visual aid: Yes ☐ No ☐**	
FSTD operator:		**FSTD ID code:**	
Total training time at the controls:		**Instrument approaches at aerodromes to a decision altitude or height of:**	
Location, date and time:		**Type and number of licence:**	
Type rating instructor ☐	**Class rating instructor ☐**	**............................ instructor ☐**	
Signature of instructor:		**Name(s) in capital letters:**	
3	**Flight training: in the aircraft ☐ in the FSTD (for ZFTT) ☐**		

Type of aircraft:	**Registration:**	**Flight time at the controls:**
Take-offs:	**Landings:**	**Training aerodromes or sites (take-offs, approaches and landings):**
Take-off time:		**Landing time:**
Location and date:		**Type and number of licence held:**
Type rating instructor ☐	**Class rating instructor** ☐	
Signature of instructor:		**Name(s) in capital letters:**
4	**Skill test** ☐	**Proficiency check** ☐
Skill test and proficiency check details:		
Aerodrome or site:		**Total flight time:**
Take-off time:		**Landing time:**
Pass ☐	**Fail** ☐	**Reason(s) why, if failed:**
Location and date:		**SIM or aircraft registration:**
Examiner's certificate number (if applicable):		**Type and number of licence:**
Signature of examiner:		**Name(s) in capital letters:**

AMC2 to Appendix 9 Training, skill test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

TRAINING, SKILL TEST AND PROFICIENCY CHECK: SP AEROPLANES

Section 3.B of the training and skill test and proficiency check content for SP aeroplanes included in Appendix 9.B should include training on a circling approach, after an IFR approach.