

Brunei Department of Civil Aviation

Negara Brunei Darussalam

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Brunei Aviation Requirements

BAR 1 Part FCL - Acceptable Means of Compliance & Guidance Material

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Control of this Document

DC.1 Introduction

DC.1.1 Pursuant to Civil Aviation Order 2006 and the Civil Aviation Requirements 2006 and their subsequent amendments, the following requirements are hereby established for compliance by all persons concerned, the Director of Civil Aviation is empowered to adopt and amend Brunei Aviation Requirements. In accordance herewith, the following AMC & GM is hereby established for compliance by all persons concerned. This AMC & GM shall be known as BAR 1 Part FCL - Acceptable Means of Compliance & Guidance Material and any reference to this title shall mean referring to these regulations governing the requirements to be met for the certification of personnel licensing.

DC.2 Authority for this Regulation

DC.2.1 This BAR 1 Part FCL - Acceptable Means of Compliance & Guidance Material is issued on the authority of the Director of Civil Aviation.

DC.3 Applicability

DC.3.1 This BAR 1 Part FCL - Acceptable Means of Compliance & Guidance Material is applicable to the aviation industry of the .

DC.4 Scope

DC.4.1 BAR 1 Personnel Licensing Acceptable Means of Compliance & Guidance Material contains the acceptable means of compliance and guidance material for the personnel licensing regulations and shows compliance with ICAO Annex 1. The AMC & GM are separated into the following parts with cross references between parts where applicable.

- Part ARA Authority Requirements for Aircrew AMC & GM
- Part ORA Organisational Requirements for Aircrew AMC & GM
- **Part FCL Flight Crew Licensing AMC & GM**
- Part CC Cabin Crew AMC & GM
- Part FOO/FD Flight Operation Officer and Flight Dispatcher AMC & GM
- Part MED Medical AMC & GM
- Part 66 Aircraft Maintenance Licence AMC & GM
- Part 147 Approved Training Organisations AMC & GM
- Part ATCO Air Traffic Control Officer AMC & GM

DC.5 Definitions

DC.5.1 Terms not defined shall have the meaning given to them in the relevant legal instruments or international legal instruments in which they appear, especially as they appear in the Convention and its Annexes.

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BAR 1 Part FCL - Acceptable Means of Compliance & Guidance Material

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Subpart A - General Requirements

GM1 FCL.005 Scope

Interpretative material

Whenever licences, ratings, approvals or certificates are mentioned in BAR 1 Part-FCL, these are meant to be valid licences, ratings, approvals or certificates issued in accordance with BAR 1 Part -FCL. In all other cases, these documents are specified.

Whenever an inclusive or exclusive 'or' is used, it should be understood within the context of the whole meaning of the requirement in which it is used.

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
AoA	Angle of Attack
AOH	Aircraft Operating Handbook
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

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ATPL	Airline Transport Pilot Licence
ATS	Air Traffic Service
AUM	All Up Mass
AUPRTA	Airplane Upset Prevention and Recovery Training Aid
B	Balloon
BCAR	British Civil Airworthiness Requirement
BEM	Basic Empty Mass
BIR	Basic Instrument Rating
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
CDFA	Constant-Descent Final Approach
CDI	Course Deviation Indicator
CFI	Chief Flight Instructor
CG	Centre of Gravity
CP	Co-pilot
CPL	Commercial Pilot Licence
CRE	Class Rating Examiner
CRI	Class Rating Instructor
CRM	Crew Resource Management
CS	Certification Specification
CTKI	Chief Theoretical Knowledge Instructor
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
DTO	Declared Training Organisation
DVE	Degraded Visual Environment
ECQB	European Central Question Bank
EFIS	Electronic Flight Instrument System
EIR	En route instrument rating
EOL	Engine Off Landings
ERPM	Engine Revolutions Per Minute

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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
IOS	Instructor Operating Station

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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
LOC-I	Loss of Control In-flight
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
OEM	Original Equipment Manufacturer
OGE	Out of Ground Effect
OML	Operational Multi-pilot Limitation
OSL	Operational Safety Pilot Limitation

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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
POM	Pilot Operating Manual
PPL	Private Pilot Licence
QDM	Magnetic Heading (aircraft to station)
QDR	Magnetic Heading (station to aircraft)
QFE	Atmospheric pressure at aerodrome elevation
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RAIM	Receiver Autonomous Integrity Monitoring
RNAV	Radio Navigation
RPM	Revolutions Per Minute
RRPM	Rotor Revolutions 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

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TAS	True Air Speed
TAWS	Terrain Awareness Warning System
TCH	Type Certificate Holder
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
UPRT	Upset Prevention and Recovery Training
UTC	Coordinated Universal Time
V	Velocity
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOLMET	Meteorological Information for Aircraft In-Flight
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.

GM3 FCL.010 Definitions

UPSET PREVENTION AND RECOVERY TRAINING (UPRT) DEFINITIONS

In the context of UPRT, the following abbreviations apply to the Acceptable Means of Compliance and Guidance Material to Part-FCL:

'**Advanced UPRT**' refers to the advanced UPRT course in accordance with point FCL.745.A.

'**Aeroplane upset'** refers to an undesired aircraft state characterised by unintentional divergences from parameters normally experienced during operations. An aeroplane upset

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may involve pitch and/or bank angle divergences as well as inappropriate airspeeds for the conditions.

'Angle of Attack (AoA)' refers to the angle between the oncoming air, or relative wind, and a defined reference line on the aeroplane or wing.

'Approach-to-stall' refers to flight conditions bordered by the stall warning and stall.

'Basic UPRT' refers to the UPRT elements and exercises integrated into training courses for the issue of a CPL, MPL or Phases 1 to 3 of the integrated ATP course.

'Developed upset' refers to a condition meeting the definition of an aeroplane upset.

'Developing upset' refers to any time the aeroplane begins to unintentionally diverge from the intended flight path or airspeed.

'Energy state' refers to how much of each kind of energy (kinetic, potential or chemical) the aeroplane has available at any given time.

'First indication of a stall' refers to the initial aural, tactile or visual sign of a stall event which can be either naturally or synthetically induced.

'**Flight crew resilience'** refers to the ability of a flight crew member to recognise, absorb and adapt to disruptions.

'Fidelity level' refers to the level of realism assigned to each of the defined FSTD features.

'Flight path' refers to the trajectory or path of the aeroplane travelling through the air over a given space of time.

'Flight path management' refers to active manipulation, using either the aeroplane's automation or manual handling, to command the aeroplane's flight controls in order to direct the aeroplane along a desired trajectory.

'FSTD validation envelope' refers to the envelope consisting of the following three subdivisions:

(a) Flight test validated region

This is the region of the flight envelope which has been validated with flight test data, typically by comparing the performance of the FSTD against the flight test data through tests incorporated in the qualification test guide (QTG) and other flight test data utilised to further extend the model beyond the minimum requirements. Within this region, there is high confidence that the simulator responds similarly to the aircraft. Note that this region is not strictly limited to what has been tested in the QTG; as long as the aerodynamics mathematical model has been conformed to the flight test results, that portion of the mathematical model can be considered to be within the flight test validated region.

(b) Wind tunnel and/or analytical region

This is the region of the flight envelope for which the FSTD has not been compared to flight test data, but for which there has been wind tunnel testing or the use of other

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reliable predictive methods (typically by the aircraft manufacturer) to define the aerodynamic model. Any extensions to the aerodynamic model that have been evaluated in accordance with the definition of an exemplar stall model (as described in the stall manoeuvre evaluation section) must be clearly indicated. Within this region, there is moderate confidence that the simulator will respond similarly to the aircraft.

(c) Extrapolated region

This is the region extrapolated beyond the flight test validated and wind tunnel/analytical regions. The extrapolation may be a linear extrapolation, a holding of the last value before the extrapolation began, or some other set of values. Whether this extrapolated data is provided by the aircraft or simulator manufacturer, it is a 'best guess' only. Within this region, there is low confidence that the simulator will respond similarly to the aircraft. Brief excursions into this region may still retain a moderate confidence level in FSTD fidelity; however, the instructor should be aware that the FSTD's response may deviate from that of the actual aircraft.

'Load factor' refers to the ratio of a specified load to the weight of the aeroplane, the former being expressed in terms of aerodynamic forces, propulsive forces or ground reactions.

'**Loss of Control In-flight (LOC-I)**' refers to a categorisation of an accident or incident resulting from a deviation from the intended flight path.

'Manoeuvre-based training' refers to training that focuses on a single event or manoeuvre in isolation.

'Negative training' refers to training which unintentionally introduces incorrect information or invalid concepts, which could actually decrease rather than increase safety.

'Negative transfer of training' refers to the application (and 'transfer') of what was learned in a training environment (i.e. a classroom, an FSTD) to normal practice, i.e. it describes the degree to which what was learned in training is applied to actual, normal practices. In this context, negative transfer of training refers to the inappropriate generalisation of knowledge and skills to a situation or setting in normal practice that does not equal the training situation or setting.

'**Original Equipment Manufacturer (OEM**)' refers to the original equipment manufacturer of an aircraft or associated parts or equipment or of parts or equipment installed on the basis of a supplemental type certificate (STC).

'Post-stall regime' refers to flight conditions at an AoA greater than the critical AoA.

'Scenario-based training' refers to training that incorporates manoeuvres into real-world experiences to cultivate practical flying skills in an operational environment.

'Stall' refers to loss of lift caused by exceeding the aeroplane's critical AoA.

Note: A stalled condition can exist at any attitude and airspeed, and may be recognised by continuous stall warning activation accompanied by at least one of the following:

(a) buffeting, which could be heavy at times;

(b) lack of pitch authority and/or roll control; and

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(c) inability to arrest the descent rate.

Note: It is possible that in certain conditions the stall warning may not be activated.

'Stall event' refers to an occurrence whereby the aeroplane experiences conditions associated with an approach-to-stall or a stall.

'Stall (event) recovery procedure' refers to the manufacturer-approved aeroplane-specific stall recovery procedures, such as those contained in the flight crew operations manual (FCOM). If an OEM- approved recovery procedure does not exist, the aeroplane-specific stall recovery procedure developed by the ATO, based on the stall recovery template, may be used.

'Stall warning' refers to a natural or synthetic indication provided when approaching a stall that may include one or more of the following indications:

(a) aerodynamic buffeting (some aeroplanes will buffet more than others);

(b) reduced roll stability and aileron effectiveness;

(c) visual or aural cues and warnings;

(d) reduced elevator (pitch) authority;

(e) inability to maintain altitude or arrest rate of descent; and

(f) stick shaker activation (if installed).

Note: A stall warning indicates an immediate need to reduce the AoA.

'Startle' refers to the initial, short-term, involuntary physiological and cognitive reactions to an unexpected event that commence the normal human stress response.

'Stick pusher' refers to any device that automatically applies a nose-down movement and pitch force to an aeroplane's control columns to attempt to decrease the aeroplane's AoA. Device activation may occur before or after aerodynamic stall, depending on the aeroplane type.

Note: A stick pusher is not installed on all aeroplane types.

'Stick shaker' refers to a device that automatically vibrates the control column to warn the pilot of an approaching stall.

Note: A stick shaker is not installed on all aeroplane types.

'**Stress (response)'** refers to the response to a threatening event that includes physiological, psychological and cognitive effects. These effects may range from positive to negative and can either enhance or decrease performance.

'Surprise' refers to the emotionally based recognition of a difference in what was expected and what is actual.

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'Train-to-proficiency' refers to approved training designed to achieve end-state performance objectives, providing sufficient assurances that the trained individual is capable of consistently carrying out specific tasks safely and effectively.

Note: In the context of this definition, 'train-to-proficiency' can be replaced by 'training-to-proficiency'.

'Type-specific UPRT' refers to UPRT elements and exercises integrated into training courses for the issue of a class or type rating pursuant to Part-FCL or during recurrent or refresher training for a specific aeroplane class or type.

'Undesired aircraft state' refers to flight-crew-induced aircraft position or speed deviation, misapplication of controls, or incorrect systems configuration, associated with a reduction in margins of safety.

Note (1): Undesired states can be managed effectively, restoring margins of safety, or flight crew response(s) can induce an additional error, incident or accident.

Note (2): All countermeasures are necessary flight crew actions. However, some countermeasures to threats, errors and undesired aircraft states that flight crew employ are built upon 'hard'/systemic- based resources provided by the aviation system.

'Unsafe situation' refers to a situation which has led to an unacceptable reduction in safety margin.

'Unusual attitude' refers to an aircraft in flight intentionally exceeding the parameters normally experienced in line operations or training, as applicable.

'Incipient spin' refers to a transient flight condition in the post-stall regime where an initial, uncommanded roll in excess of 45° has resulted from yaw asymmetry during a stall and which, if recovery action is not taken, will lead rapidly to a developing spin. Prompt recovery during this incipient spin stage will normally result in an overall heading change, from pre-stall conditions, of not more than 180°.

'**Developing spin'** refers to a flight condition in the post-stall regime where the aeroplane exhibits abnormal, but varying, rates of yaw and roll, together with changing pitch attitude, following an incipient spin but before the establishment of a developed spin. A developing spin follows an unrecovered incipient spin and will usually persist, in the absence of any recovery action, until a developed spin ensues.

'Developed spin' refers to a flight condition in the post-stall regime where the aeroplane has achieved approximately constant pitch attitude, yaw rate and roll rate on a descending flight path. In transition from a stall with significant, persistent yaw, with no recovery action, to attaining a developed spin, the aeroplane is likely to have rolled through at least 540°.

'FSTD training envelope' refers to the high and moderate confidence regions of the FSTD validation envelope.

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GM4 FCL.010 Definitions

DEFINITIONS IN GM3 FCL.010 RELATED TO THE POST-STALL REGIME

The definitions for 'incipient spin', developing spin' and 'developed spin' in GM3 FCL.010 relate to the post-stall regime in aeroplanes that might typically be used in the context of the advanced UPRT in accordance with point FCL.745.A. The definitions are not intended for application to commercial air transport operations.

GM5 FCL.010 Definitions

AVAILABLE AND ACCESSIBLE FSTDs

a) To determine the availability of an FSTDs, the following additional criteria should be taken into account.

The FSTDs should be:

1. Certified by a competent authority within the scope of the Basic Regulation;
2. Approved by the competent authority for the use within the scope of the Basic Regulation;
3. Representative of the operator's or applicant's aircraft class or type, and serviceable; and
4. Representative of the configuration of the operator's or applicant's aircraft.

b) To determine the accessibility of an FSTDs, the following additional criteria should be taken into account.

The FSTDs should be:

1. Accessible to the instructor or examiner of the applicant;
2. Accessible for the use within the scope of the candidate's/operator's training and checking activities; and
3. Accessible to allow normal programming and prevent excessive scheduling disruptions within the operator's crew roster patterns.

c) 'Irrespective of any time considerations' means that the FSTD may be used at any time during day or night.

d) If an FSTD is not available or accessible, mitigating measures to ensure the required level of safety should be agreed with the competent authority before testing or checking the applicant in an aircraft.

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, 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.

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GM1 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, which covers one subject required by the licence level or rating, 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 Brunei DCA 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.

AMC1 FCL.025(a)(2) Theoretical knowledge examinations for the issue of licences and ratings

COMPLETION OF THE AREA 100 KSA ASSESSMENT BEFORE FINAL EXAMINATION

Before being recommended by an ATO to sit the final examination paper at the first attempt, an applicant for a professional licence should have successfully completed the applicable Area 100 KSA summative assessments and mental maths test at the ATO.

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.

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(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 Brunei DCA, 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.

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(c) Format of the record:

(1) details of flights flown under commercial air transport may be recorded in an electronic 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 in aeroplanes, helicopters and powered lift category, the pilot should record the details of the flights flown in the following logbook format which may be kept in electronic format. All data set out in (a) should be included.

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PILOT LOGBOOK

Holder's name(s) _____

Holder's licence number _____

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HOLDER'S ADDRESS:	
	[space for address change]
[space for address change]	*[space for address change]*
[space for address change]	*[space for address change]*

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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									

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

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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 flight crew logbook should comply with following:

1. In case of paper records, they should be made in ink or indelible pencil; or

2. In case of electronic records, they should be made and kept in a way to be readily available at the request of Brunei DCA, and contain all relevant items that are mentioned in (a), certified by the pilot, and in a format acceptable by Brunei DCA.

(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, 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;

(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;

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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
08/04/15	BWN	1025	BWN	1240	PA34-250	V8-ABC		✓			2	15	SELF	1	
09/04/15	BWN	1810	BWN	1930	C152	V8-XYZ	✓				1	20	SELF		2
11/04/15	BWN	1645	DXB	0025	B787-8	V8-DLA			7	40	7	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.

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(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 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

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AMC1 FCL.055 Language proficiency

General

(a) The method of assessment of the language proficiency level (hereinafter: 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 Brunei DCA.

(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 Brunei DCA may use its own resources in developing or conducting the language proficiency assessment, or may delegate this task to language testing bodies.

(i) The Brunei DCA 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 Brunei DCA 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.

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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 and 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.

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(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.

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-testing bodies

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

(1) To be accepted, the language-testing 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-testing 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.

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(3) The assessment documentation and records should be kept for a period of time determined by the Brunei DCA and made available to the Department, 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 Brunei DCA 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.

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AMC2 FCL.055 Language proficiency

Rating scale

The following table describes the different levels of language proficiency:

LEVEL	PRONUNCIATION Assumes a dialect or accent intelligible to the aeronautical community	STRUCTURE Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task	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, 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.

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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 sometimes idiomatic.	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 unexpected turn of events. Is able to comprehend a range of speech varieties (dialect or accent) or registers.	Responses are immediate, appropriate, and informative. Manages the speaker or listener relationship effectively.
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.

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Pre-Operational (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.
Elementary (Level 2)	Pronunciation, stress, rhythm, and intonation are heavily influenced by the first language or regional variation and usually interfere with ease of understanding.	Shows only limited control of few simple memorised grammatical structures and sentence patterns.	Limited vocabulary range consisting only of isolated words and memorised phrases.	Can produce very short, isolated, memorised utterances with frequent pausing and a distracting use of fillers to search for expressions and articulate less familiar words.	Comprehension is limited to isolated, memorised phrases when they are carefully and slowly articulated.	Response time is slow, and often inappropriate. Interaction is limited to simple routine exchanges.
Pre-Elementary (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.

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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 operation 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 Brunei DCA 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.

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.

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

Aeroplanes and helicopters

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:

Group 1: Bell 206/206L, Bell 407;

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

Group 3: SA 341/342, EC 120;

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

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

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Subpart B - Light Aircraft Pilot Licence - LAPL

SECTION 1 – COMMON REQUIREMENTS

AMC1 FCL.115 LAPL(A) Training Course

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 applicants to undertake their first solo flight, the FI should ensure that the applicants can use R/T communication and 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;

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(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.

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(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;

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(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 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;

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(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 to undergo dual conversion training before flying tail wheel aeroplanes, 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 re-joining 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;

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(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:

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(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 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;

(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);

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(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.

AMC2 FCL.115 LAPL(H) Training course

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;

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(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 applicants to undertake their first solo flight, the FI should ensure that the applicants can use R/T communication and 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;

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(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:

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(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:

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(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;

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(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.

(xviii) 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.

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(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;

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(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.

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(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.

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(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 in map reading;

(D) effects of wind and turbulence;

(E) avoidance of noise-sensitive areas;

(F) action in case of DVE;

(G) decisions to divert or make a precautionary landing;

(H) bad-weather circuit and landing;

(I) appropriate procedures and choice of landing area;

(J) precautionary landing.

(xxxii) Exercise 22c: 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.

(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;

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(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;

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(M) vertical take-off from hover.

AMC1 FCL.115(c) LAPL Training course

Change of training organisation

In case where the applicant completes the training course (theoretical knowledge instruction or flight instruction) at a different DTO or ATO ('completing training organisation') from the one where they have started the training course ('starting training organisation'), the applicant should request from the starting training organisation a copy of the records kept in accordance with point DTO.GEN.220 or point ORA.ATO.120.

AMC1 FCL.115; FCL.120 LAPL training course and theoretical knowledge examination

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 DTO or the ATO responsible for the training has to check if all the appropriate elements of the training course of theoretical knowledge instructions 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; FCL.215 should be used for the LAPL(A) and the LAPL(H), respectively.

I. COMMON SUBJECTS

For LAPL(S) and LAPL(B) - RESERVED

II. ADDITIONAL SUBJECTS FOR EACH CATEGORY

A. Sailplanes - RESERVED

B. Balloons - RESERVED

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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 Brunei DCA 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

(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.

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 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.

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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

(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:

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	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;

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(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) 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)

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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 - RESERVED

AMC2 FCL.125; FCL.235 - RESERVED

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SECTION 2 – SPECIFIC REQUIREMENTS FOR THE LAPL FOR AEROPLANES – LAPL(A)

AMC1 FCL.105.A(b)(2) Privileges and conditions

In the case of previous MPL(A) holders, only those who extended their MPL(A) to include CPL privileges or PPL privileges in accordance with point FCL.405.A(b) may benefit from the exemption of point FCL.105.A(b)(2).

AMC1 FCL.115 LAPL(A) Training course[1]

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.115.

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.

AMC1 FCL.140.A; FCL.140.S; FCL.740.A(b)(1)(ii) Recency and revalidation requirements

All hours flown on aeroplanes that are subject to a decision as per Article 2(8) of the Basic Regulation or that are specified in Annex I to the Basic Regulation should count in full towards fulfilling the hourly requirements of points FCL.140.A, FCL.140.S, and FCL.740.A(b)(1)(ii) under the following conditions:

(a) the aircraft matches the definition and criteria of the respective Part-FCL aircraft category, class, and type ratings; and

(b) the aircraft that is used for the training flights with an instructor is an Annex-I aircraft of type (a), (b), (c) or (d) that is subject to an authorisation specified in points ORA.ATO.135 or DTO.GEN.240.

AMC1 FCL.140.A; FCL.140.H; Recency requirements

Training flight items should be based on the exercise items of the proficiency check, as deemed relevant by the instructor, and depending on the experience of the candidate. For aeroplanes and helicopters, the briefing should include a discussion on TEM with special emphasis on decision-making when encountering adverse meteorological conditions or unintentional IMC, as well as navigation flight capabilities.

AMC1 FCL.140.A(b)(1) LAPL(A) Recency requirements

The proficiency check should follow the content of the skill test that is set out in AMC1 FCL.125, point (e).

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SECTION 3 – SPECIFIC REQUIREMENTS FOR THE LAPL FOR HELICOPTERS – LAPL(H)

AMC1 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 AMC2 FCL.115.

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.

AMC1 FCL.140.H(b)(1) LAPL(H) Recency requirements

The proficiency check should follow the content of the skill test that is set out in AMC2 FCL.125, point (e).

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

AMC1 FCL.110.S; FCL.210.S - RESERVED

AMC1 FCL.135.S; FCL.205.S(a) - RESERVED

AMC1 FCL.140.S(c)(1) LAPL(S) Recency requirements - RESERVED

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

AMC1 FCL.110.B; FCL.210.B - RESERVED

AMC1 FCL.130.B; FCL.220.B - RESERVED

AMC1 FCL.135.B; FCL.225.B - RESERVED

AMC2 FCL.135.B; FCL.225.B - RESERVED

AMC3 FCL.135.B; FCL.225.B - RESERVED

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Subpart C - Private Pilot Licence (PPL)

SECTION 1 – COMMON REQUIREMENTS

AMC1 FCL.210 PPL(A) Training course

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 applicants for a PPL(A) to undertake their first solo flight, the FI should ensure that the applicants can use R/T communication and 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;

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(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;

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(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.

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(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.

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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;

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(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.

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(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;

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(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.

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(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.

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AMC2 FCL.210 PPL(H) Training course

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 their first solo flight, the FI should ensure that the applicants can use R/T communication and can operate the required systems and equipment.

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(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.

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(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;

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(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;

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(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);

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(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.

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(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:

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(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.

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(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;

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(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;

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(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;

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(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.

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AMC1 FCL.210(c) Training course

Change of training organisation

In cases where the applicant completes the training course (theoretical knowledge instruction or flight instruction) at a different DTO or ATO ('completing training organisation') from the one where they have started the training course ('starting training organisation'), the applicant should request from the starting training organisation a copy of the records kept in accordance with point DTO.GEN.220 or point ORA.ATO.120

AMC1 FCL.210; FCL.215 Training course and theoretical knowledge examination

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.

The DTO or the ATO responsible for the training should 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	Bridge course	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				
	Part I Air Navigation: relevant parts of the following chapters: (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.	x		x	
	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	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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)				
	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: (a) indicators and signalling devices; (b) markings; (c) lights; (d) signs; (e) markers.	x		x	
	Visual aids for denoting obstacles: (a) marking of objects; (b) lighting of objects.	x		x	
	Visual aids for denoting restricted use of areas	x		x	
	Emergency and other services: (a) rescue and fire fighting;	x		x	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) apron management service.				
	Annex 12: Search and rescue				
	Essential definitions	x		x	
	Operating procedures: (a) procedures for PIC at the scene of an accident; (b) procedures for PIC intercepting a distress transmission; (c) search and rescue signals.	x		x	
	Search and rescue signals: (a) signals with surface craft; (b) ground or air visual signal code; (c) air or ground signals.	x		x	
	Annex 17: Security				
	General: aims and objectives	x		x	
	Annex 13: Aircraft accident investigation				
	Essential definitions Applicability	x x		x x	
	National law				
	National law and differences to relevant ICAO Annexes and relevant EU regulations.	x		x	
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: (a) composition; (b) gas laws.	x		x	
	Respiratory and circulatory systems: (a) oxygen requirement of tissues; (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.	x		x	
	Man and environment				
	Central, peripheral and autonomic nervous systems	x		x	
	Vision: (a) functional anatomy; (b) visual field, foveal and peripheral vision; (c) binocular and monocular vision; (d) monocular vision cues;	x		x	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(e) night vision; (f) visual scanning and detection techniques and importance of 'look-out'; (g) defective vision.				
	Hearing: (a) descriptive and functional anatomy; (b) flight related hazards to hearing; (c) hearing loss.	x		x	
	Equilibrium: (a) functional anatomy; (b) motion and acceleration; (c) motion sickness.	x		x	
	Integration of sensory inputs: (a) spatial disorientation: forms, recognition and avoidance; (b) illusions: forms, recognition and avoidance: (1) physical origin; (2) physiological origin; (3) psychological origin. (c) approach and landing problems.	x		x	
	Health and hygiene				
	Personal hygiene: personal fitness	x		x	
	Body rhythm and sleep: (a) rhythm disturbances; (b) symptoms, effects and management.	x		x	
	Problem areas for pilots: (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.	x		x	
	Intoxication: (a) prescribed medication; (b) tobacco; (c) alcohol and drugs; (d) caffeine; (e) self-medication.	x		x	
	Basic aviation psychology				
	Human information processing				
	Attention and vigilance: (a) selectivity of attention; (b) divided attention.	x		x	
	Perception: (a) perceptual illusions; (b) subjectivity of perception; (c) processes of perception.	x		x	
	Memory:	x		x	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) sensory memory; (b) working or short term memory; (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: (a) structure (phases); (b) limits; (c) risk assessment; (d) practical application.	x		x	
	Avoiding and managing errors: cockpit management				
	Safety awareness: (a) risk area awareness; (b) situational awareness.	x		x	
	Communication: verbal and non-verbal communication	x		x	
	Human behaviour				
	Personality and attitudes: (a) development; (b) environmental influences.	x		x	
	Identification of hazardous attitudes (error proneness)	x		x	
	Human overload and underload				
	Arousal	x		x	
	Stress: (a) definition(s); (b) anxiety and stress; (c) effects of stress.	x		x	
	Fatigue and stress management: (a) types, causes and symptoms of fatigue; (b) effects of fatigue; (c) coping strategies; (d) management techniques; (e) health and fitness programmes;	x		x	
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	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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				
	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	
	General global circulation				
	General circulation around the globe	x		x	
	Local winds				
	Anabatic and katabatic winds, mountain and valley winds, *Venturi* effects, land and sea breezes	x		x	
	Mountain waves (standing waves, lee waves)				
	Origin and characteristics	x		x	
	Turbulence				
	Description and type of turbulence	x		x	
	Formation and location of turbulence	x		x	
	THERMODYNAMICS				
	Humidity				
	Water vapour in the atmosphere	x		x	
	Mixing ratio	x		x	
	Temperature/dew point, relative humidity	x		x	
	Change of state of aggregation				
	Condensation, evaporation, sublimation, freezing and melting, latent heat	x		x	
	Adiabatic processes				
	Adiabatic processes, stability of the atmosphere	x		x	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	CLOUDS AND FOG				
	Cloud formation and description				
	Cooling by adiabatic expansion and by advection	x		x	
	Cloud types and cloud classification	x		x	
	Influence of inversions on cloud development	x		x	
	Fog, mist, haze				
	General aspects	x		x	
	Radiation fog	x		x	
	Advection fog	x		x	
	Steaming fog	x		x	
	Frontal fog	x		x	
	Orographic fog (hill fog)	x		x	
	PRECIPITATION				
	Development of precipitation				
	Processes of development of precipitation	x		X	
	Types of precipitation				
	Types of precipitation, relationship with cloud types	x		x	
	AIR MASSES AND FRONTS				
	Air masses				
	Description, classification and source regions or air masses	x		x	
	Modifications or air masses	x		x	
	Fronts				
	General aspects	x		x	
	Warm fonts, associated clouds, and weather	x		x	
	Cold front, associated clouds, and weather	x		x	
	Warm sector, associated clouds and weather	x		x	
	Weather behind the cold front	x		x	
	Occlusions, associated clouds, and weather	x		x	
	Stationary fronts, associated clouds, and weather	x		x	
	Movement of fronts and pressure systems, life cycle	x		x	
	Changes of meteorological elements at a frontal wave	x		x	
	PRESSURE SYSTEMS				
	Anticyclone				
	Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence	x		x	
	Non-frontal depressions				
	Thermal, orographic and polar depressions, troughs	x		x	
	CLIMATOLOGY				
	Climatic zones				
	General seasonal circulation in the troposphere	x		x	
	Typical weather situations in the mid-latitudes				
	Westerly situation	x		x	
	High-pressure area	x		x	
	Flat-pressure pattern	x		x	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Local winds and associated weather				
	e.g. *Foehn*	x		X	
	FLIGHT HAZARDS				
	Icing	x		X	
	Conditions for ice cream	x		X	
	types of ice accretion	x		X	
	Hazards of ice accretion, avoidance	x		X	
	Turbulence	x		x	
	Effects on flight, avoidance	x		x	
	Wind shear				
	Definition of wind shear	x		X	
	Weather conditions for wind shear	x		X	
	Effects on flight, avoidance	x		x	
	Thunderstorms				
	Conditions for, and process of, development, forecast, location, type specification	x		X	
	Structure of thunderstorms, life cycle, squall lines, electricity in the atmosphere, static charges	x		X	
	Electrical discharges	x		X	
	Development and effects of downbursts	x		X	
	Thunderstorm avoidance	x		X	
	Inversions				
	Influence on aircraft performance	x		X	
	Hazards in mountainous areas				
	Influence of terrain on clouds and precipitation, frontal passage	x		X	
	Vertical movements, mountain waves, wind shear, turbulence, ice accretion				
	Development and effect of valley inversions	x		x	
	Visibility-reducing phenomena				
	Reduction of visibility caused by precipitation and obscuration	x		X	
	Reduction of visibility caused by other phenomena	x		X	
	METEOROLOGICAL INFORMATION				
	Observation				
	Surface observations	x		x	
	Radiosonde observations	x		x	
	Satellite observations	x		x	
	Weather radar observations	x		x	
	Aircraft observation and reporting	x		x	
	Weather charts				
	Significant weather charts	x		x	
	Surface charts	x		x	
	Information for flight planning				
	Aviation weather messages	x		x	
	Meteorological broadcast for aviation	x		x	
	Use of meteorological warnings	x		x	
	Meteorological warnings	x		x	
	Meteorological services				

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	World area forecast system (WAFS) and meteorological offices	x		x	
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	
	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	
5.	**PRINCIPLES OF FLIGHT**				
5.1.	**PRINCIPLES OF FLIGHT: AEROPLANE**				
	Subsonic aerodynamics				
	Basics concepts, laws and definitions				
	Laws and definitions:	x	x		
	(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.				

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Basics about airflow: (a) streamline; (b) two-dimensional airflow; (c) three-dimensional airflow.	x	x		
	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		
	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;	x	x		

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) interference drag; (c) friction drag.				
	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: (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.	x	x		
	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); (c) use of ailerons.	x	x		
	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;	x	x		

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(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.				
	C_L augmentation				
	Trailing edge flaps and the reasons for use in take-off and landing: (a) influence on C_L - 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		
	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; (b) precondition for dynamic stability; (c) dynamic stability, positive, neutral and negative.	x	x		
	Location of centre of gravity: (a) aft limit and minimum stability margin;	x	x		

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) forward position; (c) effects on static and dynamic stability.				
	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; (b) servo tab.	x	x		
	Mass balance				
	Reasons to balance: means	x	x		
	Trimming				
	Reasons to trim	x	x		
	Trim tabs	x	x		
	Limitations				
	Operating limitations				
	Flutter	x	x		
	V_{fe}	x	x		
	V_{no}, V_{ne}	x	x		
	Manoeuvring envelope				
	Manoeuvring load diagram: (a) load factor; (b) accelerated stall speed; (c) V_a; (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		
	Effects of ice on propeller	x	x		

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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: (a) the atmosphere and International Standard Atmosphere; (b) density; (c) influence of pressure and temperature on density.			x	x
	Newton's laws: (a) Newton's second law: Momentum equation; (b) Newton's third law: action and reaction.			x	x
	Basic concepts about airflow: (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.			x	x
	Two-dimensional airflow			x	x
	Aerofoil section geometry: (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.			x	x
	Aerodynamic forces on aerofoil elements: (a) angle of attack; (b) pressure distribution; (c) lift and lift coefficient			x	x

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(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.				
	Stall: (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.			x	x
	Disturbances due to profile contamination: (a) ice contamination; (b) ice on the surface (frost, snow and clear ice).			x	x
	The three-dimensional airflow round a wing and a fuselage			x	x
	The wing: (a) planform, rectangular and tapered wings; (b) wing twist.			x	x
	Airflow pattern and influence on lift: (a) span wise flow on upper and lower surface; (b) tip vortices; (c) span-wise lift distribution.			x	x
	Induced drag: causes and vortices			x	x
	The airflow round a fuselage: (a) components of a fuselage; (b) parasite drag; (c) variation with speed.			x	x
	Transonic aerodynamics and compressibility effects				
	Airflow velocities			x	x
	Airflow speeds: (a) speed of sound; (b) subsonic, high subsonic and supersonic flows.			x	x
	Shock waves: (a) compressibility and shock waves; (b) the reasons for their formation at upstream high subsonic airflow; (c) their effect on lift and drag.			x	x
	Influence of wing planform: sweep-angle			x	x
	Rotorcraft types			**x**	**x**
	Rotorcraft			x	x
	Rotorcraft types: (a) autogyro; (b) helicopter.			x	x
	Helicopters			x	x
	Helicopters configurations: the single main rotor helicopter			x	x

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	The helicopter, characteristics and associated terminology: (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.			x	x
	Main rotor aerodynamics			**x**	**x**
	Hover flight outside ground effect			x	x
	Airflow through the rotor discs and round the blades: (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.			x	x
	Anti-torque force and tail rotor: (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.			x	x
	Maximum hover altitude OGE: (a) total power required and power available; (b) maximum hover altitude as a function of pressure altitude and OAT.			x	x
	Vertical climb			x	x
	Relative airflow and angles of attack:			x	x

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) climb velocity V_C, induced and relative velocity and angle of attack; (b) collective pitch angle and blade feathering.				
	Power and vertical speed: (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.			x	x
	Forward flight			x	x
	Airflow and forces in uniform inflow distribution: (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.			x	x
	The flare (power flight): (a) thrust reversal and increase in rotor thrust; (b) increase of rotor RPM on non-governed rotor.			x	x
	Power and maximum speed: (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.			x	x
	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

PRINTED DCA

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Vertical descent			x	x
	Vertical descent, power on: (a) airflow through the rotor, low and moderate descent speeds; (b) vortex ring state, settling with power and consequences.			x	x
	Autorotation: (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.			x	x
	Forward flight: Autorotation			x	x
	Airflow through the rotor disc: (a) descent speed and up flow through the disc; (b) the flare, increase in rotor thrust, reduction of vertical speed and ground speed.			x	x
	Flight and landing: (a) turning; (b) flare; (c) autorotative landing; (d) height or velocity avoidance graph and dead man's curve.			x	x
	Main rotor mechanics			**x**	**x**
	Flapping of the blade in hover			x	x
	Forces and stresses on the blade: (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.			x	x
	Coning angle in hover: (a) lift and centrifugal force in hover and blade weight negligible (b) flapping, tip path plane and disc area.			x	x
	Flapping angles of the blade in forward flight			x	x

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Forces on the blade in forward flight without cyclic feathering: (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.			x	x
	Cyclic pitch (feathering) in helicopter mode, forward flight: (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.			x	x
	Blade lag motion			x	x
	Forces on the blade in the disc plane (tip path plane) in forward flight: (a) forces due to the Coriolis effect because of the flapping; (b) alternating stresses and the need of the drag or lag hinge.			x	x
	The drag or lag hinge: (a) the drag hinge in the fully articulated rotor; (b) the lag flexure in the hinge less rotor; (c) drag dampers.			x	x
	Ground resonance: (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.			x	x
	Rotor systems			x	x
	See-saw or teetering rotor			x	x
	Fully articulated rotor: (a) three hinges arrangement; (b) bearings and elastomeric hinges.			x	x
	Hinge less rotor and bearing less rotor			x	x
	Blade sailing: (a) low rotor RPM and effect of adverse wind; (b) minimising the danger; (c) droop stops.			x	x

BRUNEI DCA

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Vibrations due to main rotor: (a) origins of the vibrations: in plane and vertical; (b) blade tracking and balancing.			x	x
	Tail rotors			**x**	**x**
	Conventional tail rotor			x	x
	Rotor description: (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.			x	x
	Aerodynamics: (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.			x	x
	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; (b) helicopter pitching moment and pitch angle; (c) helicopter rolling moment and roll angle.			x	x
	Forward flight: (a) forces and equilibrium conditions; (b) helicopter moments and angles; (c) effect of speed on fuselage attitude.			x	x
	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: (a) power available; (b) effects of density altitude.			x	x
	Turbine engines: (a) power available; (b) effects of ambient pressure and temperature.			x	x
	Helicopter performances			x	x
	Hover and vertical flight: (a) power required and power available; (b) OGE and IGE maximum hover height; (c) influence of AUM, pressure, temperature and density.			x	x

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Forward flight: (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.			x	x
	Manoeuvring: (a) load factor; (b) bank angle and number of g's; (c) manoeuvring limit load factor.			x	x
	Special conditions: (a) operating with limited power; (b) over pitch and over torque.			x	x
6.	**OPERATIONAL PROCEDURES**				
	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

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Passenger information	x	x	x	x
	Evacuation	x	x	x	x
	Action after landing	x	x	x	x
	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
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				
	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

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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
	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

PANEL DCA

		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 (a) masses; (b) velocities: v_x, v_y; (c) velocity of best range and of maximum endurance; (d) power limitations; (e) altitudes.			x	x
	Take-off, cruise and landing performance **Use and interpretation of diagrams and tables:** (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:			x	x

BRUNEI DCA

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(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).				
8.	**AIRCRAFT GENERAL KNOWLEDGE**				
8.1.	**AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**				
	System design, loads, stresses, maintenance				
	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		
	Brakes				
	Types and materials	x	x	x	x
	System components: design, operation, indications and warnings	x	x	x	x
	Wheels and tyres				

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Types and operational limitations	x	x	x	x
	Helicopter equipment			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
	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

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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
	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				
	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

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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
	Fuel control units: types, operation and sensors			x	x
	Helicopter air intake: different types, design, operation, materials and optional equipment			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

PROPOSED DCA

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Structural components and materials, stresses and structural limitations			x	x
	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				
	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				

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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
	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
	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				

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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
9.	**NAVIGATION**				
9.1.	**GENERAL NAVIGATION**				
	Basics of navigation				
	The solar system				
	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	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Charts				
	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				
	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	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	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	
	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	

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		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	GNSS				
	GPS, GLONASS OR GALILEO				
	Principles	x		x	
	Operation	x		x	
	Errors and accuracy	x		x	
	Factors affecting accuracy	x		x	

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AMC2 FCL.210; FCL.215 - RESERVED

AMC3 FCL.210; FCL.215 Training course and theoretical knowledge examination - RESERVED

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.

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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

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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 .

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

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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.

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(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 speed:	± 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

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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.

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AMC3 FCL.235 Skill test - RESERVED

AMC1 FCL.210.As PPL(As) Experience requirements and crediting - RESERVED

AMC1 FCL.205.S(b) SPL Privileges and conditions - RESERVED

AMC1 FCL.205.B(b) BPL Privileges and conditions - RESERVED

AMC1 FCL.225.B BPL Extension of privileges to another balloon class or group - RESERVED

AMC1 FCL.230.B(c)(1) BPL Recency requirements - RESERVED

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Subpart D - Commercial Pilot Licence - CPL

SECTION 1 – COMMON REQUIREMENTS

AMC1 FCL.310; FCL.515(b); FCL.615(b); FCL.835(d) Theoretical knowledge examinations

LEARNING OBJECTIVES FOR ATPL, CPL, IR, CB-IR(A) and EIR

(a) Aeroplanes and helicopters

GENERAL

In the tables of this AMC, the applicable LOs for each licence or rating are marked with an 'X'.

The LOs define the subject knowledge and applied knowledge, skills and attitudes that a student pilot should have assimilated during the theoretical knowledge course.

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).

ATOs are required to produce a training plan for each of their courses based on the instructional systems design (ISD) methodology as specified in AMC2 ORA.ATO.230.

Additional guidance on the meaning and taxonomy of the verbs used in the LOs can be found in GM1 FCL.310, FCL.515(b), and FCL.615(b).

TRAINING AIMS

After completion of the training, a student pilot should:

— be able to understand and apply the subject knowledge in order to be able to identify and manage threats and errors effectively;

— meet at least the Area 100 KSA minimum standard.

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 applicable legislation and standards:

Reference	Legislation/Standard
The Basic Regulation	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018

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Reference	Legislation/Standard
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 General Student Pilot Route Manual (GSPRM) contains planning data plus aerodrome and approach charts that may be used in theoretical knowledge training courses. The guidelines on its content can be found in this AMC, in front of the LO table for Subject 033 'Flight planning and monitoring'.

Excerpts from any aircraft manuals including but not limited to CAP 696, 697 and 698 for aeroplanes, and CAP 758 for helicopters may be used in training. Where questions refer to excerpts from aircraft manuals, the associated aircraft data will be provided in the examinations.

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.

Note: In all subject areas, the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).'

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DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LOs FOR ATPL, CPL, IR, CB-IR(A) and EIR

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, IR, CB-IR(A) and EIR.

For each topic in the detailed theoretical knowledge syllabus, one or more LOs are set out in the appendices as shown below:

— Appendix 010 AIR LAW

— Appendix 021 AIRCRAFT GENERAL KNOWLEDGE – AIRFRAME, SYSTEMS AND POWER PLANT

— Appendix 022 AIRCRAFT GENERAL KNOWLEDGE – INSTRUMENTATION

— Appendix 031 FLIGHT PERFORMANCE AND PLANNING – MASS AND BALANCE

— Appendix 032 FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – AEROPLANES

— Appendix 033 FLIGHT PERFORMANCE AND PLANNING – FLIGHT PLANNING AND MONITORING

— Appendix 034 FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – HELICOPTERS

— Appendix 040 HUMAN PERFORMANCE AND LIMITATIONS

— Appendix 050 METEOROLOGY

— Appendix 061 NAVIGATION – GENERAL NAVIGATION

— Appendix 062 NAVIGATION – RADIO NAVIGATION

— Appendix 070 OPERATIONAL PROCEDURES

— Appendix 081 PRINCIPLES OF FLIGHT – AEROPLANES

— Appendix 082 PRINCIPLES OF FLIGHT – HELICOPTERS

— Appendix 090 COMMUNICATIONS

— Appendix AREA 100 KNOWLEGDE, SKILLS AND ATTITUDES (KSA)

(b) Airships - RESERVED

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CPL AND IR - RESERVED

— AIRSHIPS – RESERVED

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APPENDIX TO AMC1 FCL.310; FCL.515(B); FCL.615(B) THEORETICAL KNOWLEDGE EXAMNATIONS

SUBJECT 010 – AIR LAW

Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

(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	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 00 00 00		**AIR LAW**								
010 01 00 00		**INTERNATIONAL LAW: CONVENTION, AGREEMENTS AND ORGANISATIONS**								
010 01 01 00		**The convention on International Civil Aviation (Chicago) – ICAO Doc 7300/9 Convention on the High Seas (Geneva, 29 April 1958)**								
010 01 01 01		**The establishment of the Convention on International Civil Aviation, Chicago, 7 December 1944**								
(01)	X	Explain the circumstances that led to the establishment of the Convention on International Civil Aviation, Chicago, 7 December 1944. **Source: ICAO Doc 7300/9 Preamble**	X	X	X	X	X			
010 01 01 02		**Part I – Air Navigation**								
(01)	X	Recall the general contents of relevant parts of the following chapters: - general principles and application of the Convention; - flight over territory of Contarcting States; - nationality of aircraft;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		- international standards and recommended practices (SARPs), especially notification of differences and validity of endorsed certificates and licences. **Source: ICAO Doc 7300/9 Part 1, Articles 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16, 17, 18, 19, 20, 37, 38, 39, 40**.								
(02)	X	General principles Describe the application of the following terms in civil aviation: — sovereignty; — territory and high seas according to the UN Convention on the High Seas. ***Source:*** **Convention on the High Seas (Geneva, 29 April 1958) Articles 1, 2;** **ICAO Doc 7300/9 Part 1, Articles 1, 2**	X	X	X	X	X			
(03)		Explain the following terms and 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; — Rules of the Air; — search of aircraft. ***Source:* ICAO Doc 7300/9, Articles 5, 6, 7, 10, 12, 16**	X	X	X	X	X			
(04)	X	Explain the duties of Contracting States in relation to: — documents carried on board the aircraft: — certificate of registration;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— certificates of airworthiness; — licences of personnel; — recognition of certificates and licences; — cargo restrictions; — photographic apparatus. ***Source:* ICAO Doc 7300/9, Articles 29, 31, 32, 33, 35, 36**								
011 01 01 03		***Part II – The International Civil Aviation Organization (ICAO)***								
(01)	X	Describe the objectives of ICAO. **Source: ICAO Doc 7300/9, Article 44**	X	X	X	X	X			
(02)	X	Recognise the organisation and duties of the ICAO Assembly, Council and Air Navigation Commission (ANC). ***Source:* ICAO Doc 7300/9, Articles 48, 49, 50, 54, 56, 57**	X	X	X	X	X			
(03)	X	Describe the annexes to the Convention. ***Source:* ICAO Doc 7300/9, Articles 54, 90, 94, 95**	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)**								
(01)		Explain the two technical freedoms of the air. **Source: ICAO Doc 7500**	X	X	X	X	X			
010 01 02 03		***Suppression of Unlawful Acts Against the Safety of Civil Aviation — The Tokyo Convention of 1963***								
(01)		Describe the measures and actions to be taken by the pilot-in-command (PIC) of an aircraft in order to suppress unlawful acts against the safety of the aircraft. ***Source:* ICAO Doc 8364 — Convention on Offences and Certain Other Acts**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Committed on Board Aircraft, signed in Tokyo on 14 September 1963								
010 01 02 04		**Intentionally left blank**								
010 01 02 05		**Private international law**								
(01)		Explain the legal significance of the issue of a passenger ticket or of baggage/cargo documents (that the issue is a form of contract). **Source: ICAO Doc 9740 Convention for the Unification of Certain Rules for International Carriage - The Montreal Convention of 1999**	X	X	X	X	X			
(02)		Describe the consequences for an airline or the PIC when a document of carriage is not issued (that the contract is unaffected). ***Source:* ICAO Doc 9740 Convention for the Unification of Certain Rules for International Carriage — The Montreal Convention of 1999**	X	X	X	X	X			
(03)	X	Explain the consequences for an airline operator of Regulation (EC) No 261/2004 on passenger rights in the event of delay, cancellation or denial of boarding. ***Source:* Regulation (EC) No 261/2004**	X	X	X	X	X			
(04)		Explain the liability limit in relation to destruction, loss, damage or delay of baggage. ***Source:* ICAO Doc 9740 Convention for the Unification of Certain Rules for International Carriage — The Montreal Convention of 1999**	X	X	X	X	X			
010 01 03 00		**World organisations**								
010 01 03 01		**The International Air Transport Association (IATA)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the objectives of IATA. Source: http://www.iata.org/about/pages/mission/aspx	X		X	X				
010 01 04 00		**European organisations**								
010 01 04 01		***European Union Aviation Safety Agency (EASA)*** ***Regulation (EU) 2018/1139***								
(01)	X	Describe the objectives of EASA	X	X	X	X	X			
(02)		Describe the role of EASA in European civil aviation	X	X	X	X	X			
(03)		State that the structure of the regulatory material related to EASA involves: — hard law (regulations, delegated acts, implementing acts, and implementing rules); — soft law (certification specifications, acceptable means of compliance, and guidance material).	X	X	X	X	X			
(04)		State the meaning of the terminology associated with the structure of the regulatory material related to EASA, specifically: regulations, delegated acts, implementing acts, and implementing rules, as applicable until 11 September 2023; and certification specifications, acceptable means of compliance, and guidance material.	X	X	X	X	X			
010 01 04 02		**EUROCONTROL**								
(01)	X	Describe the Single European Sky (SES) regulations.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 02 00 00		**AIRWORTHINESS OF AIRCRAFT, AIRCRAFT NATIONALITY AND REGISTRATION MARKS**								
010 02 01 00		**Intentionally left blank**								
010 02 02 00		**Certificate of Airworthiness (CofA)**								
010 02 02 01		**Certificate of Airworthiness (CofA) – Details**								
(01)		State the issuing authority of a CofA. ***Source:* ICAO Annex 8, Chapter 3.2 Issuance and continued validity of a Certificate of Airworthiness**	X	X	X	X	X			
(02)		State the necessity to hold a CofA. ***Source:* ICAO Doc 7300, Article 31**	X	X	X	X	X			
(03)	X	Explain the prerequisites for the issue of a CofA according to Commission Regulation (EU) No 748/2012. ***Source:* Commission Regulation (EU) No 748/2012, SUBPART H**	X	X	X	X	X			
(04)		State who shall determine an aircraft's continuing airworthiness. ***Source:* ICAO Annex 8, Chapter 3.2 Issuance and continued validity of a Certificate of Airworthiness**	X	X	X	X	X			
(05)		Describe how a CofA can be renewed or may remain valid. ***Source*: ICAO Annex 8** **Chapter 3.2 Issuance and continued validity of a Certificate of Airworthiness;** **Chapter 3.5 Temporary loss of airworthiness;** **Chapter 3.6 Damage to aircraft**	X	X	X	X	X			
010 02 03 00		**ICAO Annex 7 – Aircraft Nationality and Registration Marks**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 02 03 01		**ICAO Annex 7 – Definitions**								
(01)	X	Recall the definition of the following terms: aircraft; heavier-than-air aircraft; State of Registry. ***Source:* ICAO Annex 7, Chapter 1 Definitions**	X	X	X	X	X			
010 02 04 00		**Nationality marks, common marks and registration marks**								
010 02 04 01		***Nationality marks, common marks and registration marks — assignment and location*** ***Source: ICAO Annex 7***								
(01)		State the location of nationality marks, common marks and registration marks. ***Source:*** **ICAO Annex 7, Chapter 4.3 Heavier-than-air aircraft;** **ICAO Annex 7, Chapter 9 Identification plate**	X		X					
(02)		Explain who is responsible for assigning nationality marks, common marks and registration marks. ***Source:* ICAO Annex 7, Chapter 3 Nationality, common and registration marks to be used**	X	X	X	X	X			
010 03 00 00		**Intentionally left blank**								
010 04 00 00		**ICAO Annex 1**								
010 04 01 01		***Differences between ICAO Annex 1 and Regulation (EU) No 1178/2011 (hereinafter: Aircrew Regulation)***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Describe the relationship and differences between ICAO Annex 1 and the Aircrew Regulation	X	X	X	X	X	X		
010 04 02 00		**Aircrew Regulation – Annex I (Part-FCL) Source: Aircrew Regulation**								
010 04 02 01		**Definitions**								
(01)		Define the following: Category, class and type of aircraft, cross-country, dual instruction time, flight time, student pilot-in-command (SPIC), instrument time, instrument flight time, instrument ground time, night, private pilot, proficiency check, renewal, revalidation, skill test, solo flight time. ***Source:*** **Aircrew Regulation, point FCL.010 Definitions**								
(02)		Define the following: multi-crew cooperation (MCC), multi-pilot aircraft, rating. ***Source:*** **Aircrew Regulation, point FCL.010 Definitions;** **Note: 'rating' is defined in point 1.1 Definitions of ICAO Annex 1**	X	X	X	X	X			
010 04 02 02		**Content and structure**								
(01)	X	Explain the structure of Part-FCL. ***Source:*** **Aircrew Regulation, Article 1 Subject matter**	X	X	X	X	X	X		
(02)		Explain the requirements to act as a flight crew member of a civil aircraft registered in a Member State, and know the general principles of the	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		licensing system (light aircraft pilot licence (LAPL), private pilot licence (PPL), commercial pilot licence (CPL), multi-crew pilot licence (MPL), airline transport pilot licence (ATPL)). ***Source:*** **Regulation (EU) 2018/1139, Article 21 and point 2 of Annex IV 'Essential requirements for aircrew' to this Regulation;** **Aircrew Regulation, point FCL.015 Application and issue, revalidation and renewal of licences, ratings and certificates**								
(03)	X	List the two factors that are relevant to the exercise of the privileges of a licence. ***Source:*** **Aircrew Regulation, point FCL.040 Exercise of the privileges of licences**	X	X	X	X	X	X		
(04)	X	State the circumstances in which a language proficiency endorsement is required. ***Source:*** **Aircrew Regulation, point FCL.055 Language proficiency**	X	X	X	X	X	X		
(05)	X	List the restrictions for licence holders with an age of 60 years or more. ***Source:*** **Aircrew Regulation, point FCL.065 Curtailment of privileges of licence holders aged 60 years or more in commercial air transport**	X	X	X	X	X			
(06)	X	*Explain the term 'competent authority'.* ***Source:*** **Aircrew Regulation, point FCL.001 Competent authority**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Describe the obligation to carry and present documents (e.g. a flight crew licence) under Part-FCL. ***Source:* Aircrew Regulation, point FCL.045 Obligation to carry and present documents**	X	X	X	X	X	X		
010 04 02 03		**Commercial pilot licence (CPL)**								
(01)	X	State the requirements for the issue of a CPL. ***Source:* Aircrew Regulation point FCL.300 CPL — Minimum age; Appendix 3, D. CPL integrated course — Aeroplanes, Flying Training (8, a–f); Appendix 3, E. CPL modular course — Aeroplanes, Experience (12, a–d)**	X	X	X	X	X			
(02)		State the privileges of a CPL. ***Source:* Aircrew Regulation, point FCL.305 CPL — Privileges and conditions**	X	X	X	X	X			
010 04 02 04		**Airline transport pilot licence (ATPL) and multi-crew pilot licence (MPL)**								
(01)	X	State the requirements for the issue of an ATPL. ***Source:* Aircrew Regulation, point FCL.500 ATPL — Minimum age; Aircrew Regulation, point FCL.510.A ATPL(A) — Prerequisites, experience and crediting ((a) and (b)); Aircrew Regulation, point FCL.510.H ATPL(H) — Prerequisites, experience and crediting**	X		X	X				
(02)		State the privileges of an ATPL	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Aircrew Regulation, point FCL.505 ATPL - Priviliges								
(03)	X	State the requirements for the issue of an MPL. ***Source:*** **Aircrew Regulation, point FCL.400.A MPL — Minimum age;** **Aircrew Regulation, point FCL.410.A MPL — Training course and theoretical knowledge examinations and Appendix 5 (items 1 to 8)**	X							
(04)		State the priviliges of an MPL. **Source: Aircrew Regulation, point FCL.405.A MPL - Privileges**	X							
010 04 02 05		**Ratings**								
(01)		State the requirements for class ratings, their validity and privileges. ***Source:*** **Aircrew Regulation, point FCL.740 Validity and renewal of class and type ratings;** **Aircrew Regulation, point FCL.705 Privileges of the holder of a class or type rating;** **Aircrew Regulation, point FCL.720.A Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes**	X	X						
(02)		State the requirements for type ratings, their validity and privileges. ***Source:*** **Aircrew Regulation, point FCL.705 Privileges of the holder of a class or type rating;**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Aircrew Regulation, point FCL.720.A Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes; **Aircrew Regulation, point FCL.740 Validity and renewal of class and type ratings**								
(03		State the requirements for instrument ratings, their validity and privileges (instrument rating (IR), competency-based instrument rating (CB-IR) and en-route instrument rating (EIR)). ***Source:*** **Aircrew Regulation, point FCL.610 IR — Prerequisites and crediting;** **Aircrew Regulation, point FCL.605 IR — Privileges;** **Aircrew Regulation, point FCL.625 IR — Validity, revalidation and renewal**	X		X			X	X	
(04)		State the requirements for other ratings, their validity and privileges according to Part-FCL. ***Source:*** **Aircrew Regulation, point FCL.800 Aerobatic rating;** **Aircrew Regulation, point FCL.805 Sailplane towing and banner towing ratings;** **Aircrew Regulation, point FCL.810 Night rating;** **Aircrew Regulation, point FCL.815 Mountain rating;**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Aircrew Regulation, point FCL.820 Flight test rating.								
010 04 03 00		**Aircrew Regulation – Annex IV (Part-MED)**								
010 04 03 01		**Aircrew Regulation – Annex IV (Part-MED) - Details**								
(01)	X	Describe the relevant content of Part-MED — Medical requirements (administrative parts and requirements related to licensing only). ***Source:*** **Aircrew Regulation, point MED.A.001 Competent authority;** **Aircrew Regulation, point MED.A.005 Scope;** **Aircrew Regulation, point MED.A.045 Validity, revalidation and renewal of medical certificates**	X	X	X	X	X	X		
(02)		State the requirements for the issue of a medical certificate. ***Source:*** **Aircrew Regulation, point MED.A.040 Issue, revalidation and renewal of medical certificates**	X	X	X	X	X	X		
(03)		Name the class of medical certificate required when exercising the privileges of a CPL, MPL or ATPL. ***Source:*** **Aircrew Regulation, point MED.A.030 Medical certificates**	X	X	X	X	X			
(04)		State the actions to be taken in case of a decrease in medical fitness. ***Source:*** **Aircrew Regulation, point MED.A.020 Decrease in medical fitness**	X	X	X	X	X	X		
010 05 00 00		**RULES OF THE AIR ACCORDING TO ICAO ANNEX 2 AND SERA**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 05 01 00		**Overview of ICAO Annex 2 and SERA (Commission Implementing Regulation (EU) No 923/2012 and its references and subsequent amendments)**								
010 05 01 01		**ICAO Annex 2 and SERA – Relationship and content**								
(01)		Explain the scope and purpose of ICAO Annex 2.	X	X	X	X	X	X		
(02)		Explain the scope and main content of SERA. **Source: SERA, Article 1 Subject matter and scope.**	X	X	X	X	X	X		
010 05 02 00		**Rules of the Air**								
010 05 02 01		**Applicability of the Rules of the Air**								
(01)		Explain the principle of territorial application of the various Rules of the Air, e.g. ICAO, SERA, national rules. **Source:** **ICAO Annex 2, Chapter 2, 2.1 Territorial application of the rules of the Air;** **SERA.1001 and SERA.2001**	X	X	X	X	X			
(02)		Explain the necessarily to comply with the rules of the Air. **Source: SERA.2005 Compliance with the rules of the Air.**	X	X	X	X	X			
(03)		State the responsibilities of the PIC. **Source: SERA.2010 Responsibilities**	X	X	X	X	X			
(04)		Identify under what circumstances deoarture from the Rules of the Air may be allowed. **Source: SERA.2010 Responsibilities**	X	X	X	X	X			
(05)		Explain the duties of the PIC concerning pre-flight actions in case of an instrument flight rule (IFR) flight.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* SERA.2010 Responsibilities**								
(06)		State that the PIC of an aircraft has final authority as to the disposition of the aircraft while in command. ***Source:* SERA.2015 Authority of pilot-in-command of an aircraft**	X	X	X	X	X			
(07)		Explain when the use of psychoactive substances, taking into consideration their effects, by flight crew members is prohibited. ***Source:* SERA.2020 Problematic use of psychoactive substances**	X	X	X	X	X	X		
010 05 03 00		**General rules**								
010 05 03 01		**General rules – Collisions avoidance – SERA**								
(01)		Describe the rules for the avoidance of collisions. ***Source:* SERA Chapter 2 Avoidance of collisions (except water operations)**	X	X	X	X	X			
(02)		Describe the lights, including their angles, to be displayed by aircraft. ***Source:* SERA.3215 Lights to be displayed by aircraft; ICAO Annex 2, Chapter 3, 3.2.3; ICAO Annex 6, Part I, Chapter 6, 6.10 and Appendix 1; and ICAO Annex 6, Part III, Chapter 4, 4.42.**	X	X	X	X	X			
(03)		Interpreting marshalling signals. **Source: SERA Appendix 1, Chapter 4 Marshalling signals**	X	X	X	X	X			
(04)		State the basic requirements for minimum height (HGT) for the flight over congested areas of cities, towns or settlements, or over an open-air assembly of persons. ***Source:* SERA.3105 Minimum heights**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Define when the cruising levels shall be expressed in terms of flight levels (FLs). ***Source:* SERA.3110 Cruising levels**	X	X	X	X	X			
(06)		Define under what circumstances cruising levels shall be expressed in terms of altitude (ALT). ***Source:* SERA.3110 Cruising levels**	X	X	X	X	X			
(07)		Explain the limitation for proximity to other aircraft and the right-of-way rules, including holding at runway (RWY) holding positions and lighted stop bars. ***Source:*** **SERA.3205 Proximity;** **SERA.3210 Right-of-way**	X	X	X	X	X			
(08)		Describe the meaning of light signals displayed to aircraft and by aircraft. ***Source:*** **SERA.3215 Lights to be displayed by aircraft;** **SERA, Appendix 1, Chapter 3 Signals for aerodrome traffic**	X	X	X	X	X			
(09)		Describe the requirements when carrying out simulated instrument flights. ***Source:* SERA.3220 Simulated instrument flights**	X		X			X	X	
(10)		Explain the basic rules for an aircraft operating on and in the vicinity of an aerodrome (AD). ***Source:* SERA.3225 Operation on and in the vicinity of an aerodrome**	X	X	X	X	X			
(11)		Explain the requirements for the submission of an air traffic service (ATS) flight plan.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* SERA.4001 Submission of a flight plan**								
(12)		Explain the actions to be taken in case of flight plan change or delay. ***Source:*** **SERA.4015 Changes to a flight plan;** **SERA.8020 Adherence to flight plan**	X	X	X	X	X	X		
(13)		State the actions to be taken in case of inadvertent changes to track, true airspeed (TAS) and time estimate affecting the current flight plan. ***Source:* SERA.8020 Adherence to flight plan**	X	X	X	X	X	X		
(14)		Explain the procedures for closing a flight plan. ***Source:* SERA.4020 Closing a flight plan**	X	X	X	X	X			
(15)		State for which flights an air traffic control (ATC) clearance shall be obtained. ***Source:* SERA.8015 Air traffic control clearances**	X	X	X	X	X			
(16)		State how a pilot may request ATC clearance. ***Source:* SERA.8015 Air traffic control clearances**	X	X	X	X	X			
(17)		State the action to be taken if an ATC clearance is not satisfactory to a PIC. **SERA.8015 Air traffic control clearances**	X	X	X	X	X			
(18)		Describe the required actions to be carried out if the continuation of a controlled visual flight rule (VFR) flight in visual meteorological conditions (VMC) is not practicable any more.	X		X	X		X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* SERA.8020 Adherence to flight plan**								
(19)		Describe the provisions for transmitting a position report to the appropriate ATS unit including time of transmission and normal content of the message. ***Source:* SERA.8025 Position reports**	X	X	X	X	X	X	X	
(20)		Describe the necessary action when an aircraft experiences a communication (COM) failure. ***Source:* SERA.8035 Communications**	X	X	X	X	X	X	X	
(21)		State what information an aircraft being subjected to unlawful interference shall give to the appropriate ATS unit. ***Source:* SERA.11001 Unlawful interference**	X	X	X	X	X	X		
010 05 04 00		**Visual Flight rules (VFR)**								
010 05 04 01		**Visual Flight rules (VFR) – SERA**								
(01)		Describe the VFR as contained in Commission Implementing Regulation (EU) No 923/2012. ***Source:*** **SERA.5001 VMC visibility and distance from cloud minima;** **SERA.5005 Visual flight rules;** **SERA.5010 Special VFR in control zones**	X	X	X	X	X			
010 05 05 00		**Instrument Flight rules (IFR)**								
010 05 05 01		**Instrument Flight rules (IFR) – SERA**								
(01)		Describe the IFR as contained in Commission Implementing Regulation (EU) No 923/2012. ***Source:***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		SERA.5015 Instrument flight rules (IFR) — Rules applicable to all IFR flights; **SERA.5020 IFR — Rules applicable to IFR flights within controlled airspace;** **SERA.5025 IFR — Rules applicable to IFR flights outside controlled airspace**								
010 05 06 00		**Interception of civil aircraft**								
010 05 06 01		**Interception of civil aircraft – SERA**								
(01)		List the circumstances in which interception of a civil aircraft may occur. ***Source:*** **SERA.11015 Interception; ICAO Doc 9433, 1.2 Circumstances in which interception may occur**	X	X	X	X	X			
(02)		State what primary action should be carried out by an intercepted aircraft. ***Source:*** **SERA.11015 Interception**	X	X	X	X	X			
(03)		State which frequency should primarily be tried in order to contact an intercepting aircraft. ***Source:*** **SERA.11015 Interception**	X	X	X	X	X			
(04)		State on which mode and code a transponder on board the intercepted aircraft should be operated. ***Source:*** **SERA.11015 Interception**	X	X	X	X	X			
(05)		Recall the interception signals and phrases. ***Source:*** **SERA.11015 Interception, Tables S11-1, S11-2, S11-3**	X	X	X	X	X			
010 06 00 00		**AIRCRAFT OPERATIONS**								
010 06 01 00		**Intentionally left blank**								
010 06 02 00		**Definitions and abbreviations (PANS-OPS Flight Procedures, ICAO Doc 8168, Volume I)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Recall all definitions included in ICAO Doc 8168, Volume I, Part I, Section 1, Chapter 1. **Source: ICAO Doc 8168, Volume I, Part I, Section 1, Chapter 1**	X		X			X		
(02)	X	Interpret all abbreviations and acronyms as shown in ICAO Doc 8168, Volume I, Part I, Section 1, Chapter 2. **Source: ICAO Doc 8168, Volume I, Section 1, Chapter 2**	X		X			X		
010 06 03 00		**Departure procedures – (ICAO Doc 8168, Volume I)**								
010 06 03 01		**General criteria (assuming all engines operating)**								
(01)	X	State the factors dictating the design of instrument departure procedures. ***Source:*** **ICAO Doc 8168, Volume I, Part II, Section 1, Chapter 1, 1.1 General**	X		X			X	X	
(02)		Explain in which situations the criteria for omnidirectional departures are applied. ***Source:*** **ICAO Doc 8168, Volume I, Part II, Section 2, Chapter 3, Omnidirectional departures, 3.1.1; 3.1.2; 3.1.3**	X		X			X	X	
010 06 03 02		**Standard instrument departures (SIDs)**								
(01)		Explain the terms ‘straight departure’ and ‘turning departure’. ***Source:*** **ICAO Doc 8168, Volume I, Part II, Section 2, Chapter 2, 2.1 General; 2.3 Straight Departures; 2.4 Turning (excluding maximum speeds)**	X		X			X	X	
010 06 03 03		**Omnidirectional departures**								
(01)		Explain what is the meaning of an ‘omnidirectional departure’.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume I, Attachment B, paragraph 2.5**								
010 06 03 04		**Intentionally left blank**								
010 06 03 05		**Intentionally left blank**								
010 06 04 00		**Approach procedures - ICAO Doc 8168, Volume I**								
010 06 04 01		**General criteria**								
(01)		State the general criteria (except '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; — descent gradient. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1**	X		X			X		
(02)		Name the five possible segments of an instrument approach procedure. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.2.3 Segments of the approach procedure**	X		X			X	X	
(03)		State the reasons for establishing aircraft categories for the approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.4 Categories of aircraft**	X		X			X	X	
(04)		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	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.2.4 Types of approach**								
(05)		State the minimum obstacle clearance (MOC) provided by the minimum sector altitudes (MSAs) established for an aerodrome. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 4, Chapter 1, 1.3 Minimum sector altitudes (MSA)/terminal arrival altitudes (TAA)**	X		X			X	X	
(06)	X	State that a pilot shall apply wind corrections when carrying out an instrument approach procedure.	X		X			X	X	
(07)		State the most significant factor influencing the conduct of instrument approach procedures. **Source: ICAO Doc 8168, Volume II Part I, Section 2, Chapter 1**	X		X			X	X	
(08)		Explain why a pilot should not descend below obstacle clearance altitude/height (OCA/H), which are established for: — precision approach procedures; — non-precision approach procedures; — visual (circling) procedures; — APV approach procedures. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.6 Obstacle clearance altitude/height (OCA/H)**	X		X			X	X	
(09)		Describe in general terms the relevant factors for the calculation of operational minima.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume I, Part II Section 5, Chapter 1, 1.7 Factors affecting operational minima**								
(10)		State the following acronyms in plain language: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1, Chapters 1 and 2**	X		X			X	X	
(11)		Explain the relationship between the terms: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, and MDA/H. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1 General requirements**	X		X			X	X	
010 06 04 02		**Approach procedure design**								
(01)		Describe how the vertical cross section for each of the five approach segments is broken down into the various areas. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1 General requirements**	X		X			X	X	
(02)		State within which area of the cross section the minimum obstacle clearance (MOC) is provided for the whole width of the area. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 1, Chapter 1, 1.3 Areas, 1.3.1**	X		X			X	X	
(03)		Define the terms 'IAF', 'IF', 'FAF', 'FAP', 'MAPt' and 'TP'. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions, abbreviations**	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		and acronyms and units of measurement								
(04)	X	State the accuracy of facilities providing track (VHF omnidirectional radio range (VOR), instrument landing system (ILS), non-directional beacon (NDB)). ***Source:* ICAO Doc 8168, Volume I, Attachment A, Section 2, Table A-2-1. System use accuracy (2 SD) of facility providing track guidance and facility not providing track guidance**	X		X			X	X	
(05)		State the optimum descent gradient (preferred for a precision approach) in degrees and per cent. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.10 Descent gradient**	X		X			X	X	
010 06 04 03		**Arrival and approach segments**								
(01)		Name the five standard segments of an instrument approach procedure, and state the beginning and end for each of them. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1, 1.2 Instrument approach procedure**	X		X			X	X	
(02)		Describe where an arrival route normally ends. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 4 Arrival procedures, Chapter 1 General requirements**	X		X			X	X	
(03)		State the main task of the initial approach segment. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 3 Initial approach**	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Describe the maximum angle of interception between the initial approach segment and the intermediate approach segment (provided at the intermediate fix) for a precision approach and a non-precision approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 3 Initial approach**	X		X			X	X	
(05)		Describe the main task of the intermediate approach segment. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 4 Intermediate approach**	X		X			X	X	
(06)		State the main task of the final approach segment. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 5 Final approach**	X		X			X	X	
(07)		Name the two possible aims of a final approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 1 General requirements and Chapter 5 Final approach**	X		X			X	X	
(08)		Explain the term 'final approach point' in case of an ILS approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 5 Final approach**	X		X			X	X	
(09)		State what happens if an ILS glide path (GP) becomes inoperative during the approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 5 Final approach**	X		X			X	X	
010 06 04 04		**Missed approach**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Name the three phases of a missed approach procedure and describe their geometric limits. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach**	X		X			X	X	
(02)		State the main task of a missed approach procedure. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach segment**	X		X			X	X	
(03)		Define the term 'missed approach point (MAPt)'. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions, abbreviations and acronyms and units of measurement**	X		X			X	X	
(04)		Describe how an MAPt may be established in an approach procedure. **Source: ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach**	X		X			X	X	
(05)		State the pilot's action if, upon reaching the MAPt, the required visual reference is not established. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach**	X		X			X	X	
(06)		Describe what a pilot is expected to do in the event a missed approach is initiated prior to arriving at the MAPt. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach**	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		State whether the pilot is obliged to cross the MAPt at the height (HGT)/altitude (ALT) required by the procedure or whether they are allowed to cross the MAPt at a HGT/ALT greater than that required by the procedure. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 7 Missed approach**	X		X			X	X	
010 06 04 05		**Visual manoeuvring (circing) in the vicinity of the aerodrome (AD)**								
(01)		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. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(02)		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. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(03)		State for which category of aircraft the obstacle clearance altitude/height (OCA/H) within an established visual manoeuvring (circling) area is determined. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Describe how the minimum descent altitude/height (MDA/H) is specified for visual manoeuvring (circling) if the OCA/H is known. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(05)		State the conditions to be fulfilled before descending below MDA/H in a visual manoeuvring (circling) approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(06)		Explain why there can be no single procedure designed that will cater for conducting a circling approach in every situation. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(07)		State how the pilot is expected to act after initial visual contact during a visual manoeuvring (circling). ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling)**	X		X			X	X	
(08)		Describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 5, Chapter 6 Visual manoeuvring (circling) area**	X		X			X	X	
010 06 04 06		***Intentionally left blank***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Note: VOR and VOR/DME are covered under 062 02 03 00 and 062 02 04 00.								
010 06 05 01		**Holding procedures – ICAO Doc 8156, Volume I**								
010 06 05 01		**Entry and holding**								
(01)		Explain why deviations from the in-flight procedures of a holding established in accordance with ICAO Doc 8168 are dangerous. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(02)		State that if for any reason a pilot is unable to conform to the procedures for normal conditions laid down for any particular holding pattern, this pilot should advise ATC as early as possible. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(03)		Describe the shape and terminology associated with the holding pattern. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(04)		State the bank angle and rate of turn to be used whilst flying in a holding pattern. **Source: ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(05)		Explain why a pilot in a holding pattern should attempt to maintain tracks and how this can be achieved. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(06)		Describe where outbound timing begins in a holding pattern.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: ICAO Doc 8168, Volume I, Part II, Section 6								
(07)		State where the outbound leg in a holding terminates if the outbound leg is based on DME. **Source: ICAO Doc 8168, Volume I, Part II, Section 6**								
(08)		Describe the three heading entry sectors for entries into a holding pattern. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(09)		Describe the terms ‘parallel entry’, ‘offset entry’ and ‘direct entry’. **Source: ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(10)		Determine the correct entry procedure for a given holding pattern. **Source: ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(11)		State the still-air time for flying the outbound entry heading with or without DME. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(12)		Describe what the pilot is expected to do when clearance is received specifying the time of departure from the holding point. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
010 06 05 02		**Obstacle clearance**								
(01)	X	Describe the layout of the basic holding area, entry area and buffer area of a holding pattern.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**								
(02)	X	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. ***Source:* ICAO Doc 8168, Volume I, Part II, Section 6**	X		X			X	X	
(03)		Describe the different terms for ALT or flight levels (FLs) respectively, which are the references during climb or descent to change the altimeter settings from QNH to 1013.2 hPa and vice versa. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 1**	X	X	X	X	X	X	X	
(04)		Define the term 'flight level (FL)'. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions, abbreviations and acronyms and units of measurement**	X	X	X	X	X	X	X	
(05)		State where Fl zero shall be located. **Source: ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(06)		State the interval by which consecutive FLs shall be separated. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(07)		Describe how FLs are defined. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(08)		Define the term 'transition altitude (TA)'.	X	X	X	X	X	X	X	

EASA CONTROLLED

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions, abbreviations and acronyms and units of measurement**								
(09)		State how TAs shall normally be specified. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(10)		Explain how the HGT of the TA is calculated and expressed in practice. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(11)		State where TAs shall be published. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(12)		Define the term 'transition level (TRL)'. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions, abbreviations and acronyms and units of measurement**	X	X	X	X	X	X	X	
(13)		State when the TRL is normally passed on to the aircraft. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(14)		State how the vertical position of the aircraft shall be expressed at or below the TA and TRL. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(15)		Define the term 'transition layer'. ***Source:* ICAO Doc 8168, Volume I, Part I, Section 1 Definitions,**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		abbreviations and acronyms and units of measurement								
(16)		Describe when the vertical position of an aircraft passing through the transition layer shall be expressed in terms of FLs and when in terms of ALT. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(17)		State when the QNH altimeter setting shall be made available to departing aircraft. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(18)		Explain when the vertical separation of an aircraft during en-route flight shall be assessed in terms of ALT and when in terms of FLs. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
(19)		Explain when, in air–ground communications during an en-route flight, the vertical position of an aircraft shall be expressed in terms of ALT and when in terms of FLs. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
(20)		Describe why QNH altimeter-setting reports should be provided from sufficient locations. ***Source:* ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
(21)		State how a QNH altimeter setting shall be made available to aircraft approaching a controlled aerodrome (AD) for landing.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: **ICAO Doc 8168, Volume III, Section 2, Chapter 2**								
(22)		State under which circumstances the vertical position of an aircraft above the TRL may be referenced in ALT. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter 2**	X	X	X	X	X	X	X	
010 06 06 02		**Procedures for operators and pilots**								
(01)		State on which setting at least one altimeter shall be set prior to take-off. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
(02)		State where during the climb the altimeter setting shall be changed from QNH to 1013.2 hPa. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter**	X	X	X	X	X	X	X	
(03)		Describe when a pilot of an aircraft intending to land at an AD shall obtain the TRL. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
(04)		Describe when a pilot of an aircraft intending to land at an AD shall obtain the actual QNH altimeter setting. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
(05)		State where the altimeter settings shall be changed from 1013.2 hPa to QNH during descent for landing. ***Source:*** **ICAO Doc 8168, Volume III, Section 2, Chapter 3**	X	X	X	X	X	X	X	
010 06 07 00		**Parallel or near-parallel instrument RWYs – ICAO Doc 8168, Volume I**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 06 07 01		**Simultaneous operation on parallel or near-parallel instrument RWYs**								
(01)	X	Describe the difference between independent and dependent parallel approaches. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X	X	
(02)		Describe the following different operations: — simultaneous instrument departures; — segregated parallel approaches/departures; — semi-mixed and mixed operations. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X	X	
(03)		Describe the terms 'normal operating zone (NOZ)' and 'no transgression zone (NTZ)'. ***Source:* ICAO Doc 8168, Volume III, Section 1, Chapter 1; ICAO Doc 4444, Chapter 6 (Note: For the dimensions of the NTZ)**	X	X	X	X	X	X		
(04)		State the aircraft avionics requirements for conducting parallel instrument approaches. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X		
(05)		State where guidance material may be located for simultaneous operations on parallel or near-parallel instrument runways. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X		
(06)		State the radar requirements for simultaneous, independent, and parallel	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		instrument approaches, and how weather conditions effect these. ***Source:* ICAO Doc 8168 Volume III, Section 3, Chapter 1; ICAO Doc 4444, Chapter 6**								
(07)		State the maximum angle of interception for an ILS localiser course (CRS) or microwave landing system (MLS) final approach track in case of simultaneous, independent, and parallel instrument approaches. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X		
(08)		Describe the special conditions for tracks on missed approach procedures and departures in case of simultaneous or parallel operations. ***Source:* ICAO Doc 8168, Volume III, Section 3, Chapter 1**	X	X	X	X	X	X		
010 06 08 00		**Secondary surveillance radar (transponder) operating procedures — ICAO Doc 8168**								
010 06 08 01		**Operations of transponders**								
(01)		State when and where the pilot shall operate the transponder. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(02)		State the modes and codes that the pilot shall operate in the absence of any ATC directions or regional air navigation agreements. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(03)		State when the pilot shall operate Mode C.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**								
(04)		State when the pilot shall 'SQUAWK IDENT'. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(05)		State the transponder code to indicate: — a state of emergency; — a COM failure; — unlawful interference. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(06)		Describe the consequences of a transponder failure in flight. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(07)		State the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at the given AD is possible. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**	X	X	X	X	X	X	X	
(08)		State when the pilot shall operate Mode S. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 1**							X	
010 06 08 02		***Operation of airborne collision avoidance system (ACAS) equipment***								
(01)		Describe the main reason for using ACAS. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.1 ACAS overview**	X	X	X	X	X	X	X	
(02)		State whether the 'use of ACAS indications' described in ICAO Doc 8168 is absolutely mandatory.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**								
(03)		Explain the pilots' reaction required to allow ACAS to fulfil its role of assisting pilots in the avoidance of potential collisions. ***Source:*** **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
(04)		Explain why pilots shall not manoeuvre their aircraft in response to traffic advisories (TAs) only. ***Source:*** **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
(05)		Explain the significance of TAs in view of possible resolution advisories (RAs). ***Source:*** **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
(06)		State why a pilot should follow RAs immediately. ***Source:*** **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
(07)		List the reasons which may force a pilot to disregard an RA. ***Source:*** **ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
(08)		Explain the importance of instructing ATC immediately that an RA has been followed.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**								
(09)		Explain the duties of a pilot with regard to ATC when an RA situation is resolved. ***Source:* ICAO Doc 8168, Volume III, Section 4, Chapter 3, 3.2 Use of ACAS indications**	X	X	X	X	X	X		
010 06 09 00		**REGULATION (EU) No 965/2012 ON AIR OPERATIONS**								
010 06 09 01		**Regulation structure**								
(01)		Describe the subject matter and scope of that Regulation. ***Source:* Regulation (EU) No 965/2012, Article 1 Subject matter and scope**	X	X	X	X	X	X		
(02)	X	State that Regulation (EU) No 965/2012 covers all types of commercial and non-commercial operations.	X	X	X	X	X	X	X	
010 06 09 02		**Definitions (Annex I)**								
(01)		Recall the definitions in the Regulation not already given in ICAO PAN-OPS. *Source:* Regulation (EU) No 965/2012, Article 2 Definitions	X	X	X	X	X	X	X	
010 06 09 03		***Part-SPA (Annex V), Part-NCC (Annex VI) and Part-NCO (Annex VII)***								
(01)		Describe the scope of these Parts.	X	X	X	X	X			
(02)	X	Explain the main content of these Parts	X	X	X	X	X			
010 07 00 00		**AIR TRAFFIC SERVICES (ATS) AND AIR TRAFFIC MANAGEMENT (ATM)**								
010 07 01 00		**ICAO Annex 11 – Air Traffic Services**								
010 07 01 01		**Definitions**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Recall the definitions given in ICAO Annex 11. ***Source:* ICAO Annex 11, Chapter 1 Definitions**	X	X	X	X	X	X		
010 07 01 02		**General**								
(01)	X	State the objectives of ATS. ***Source:* ICAO Annex 11, Chapter 2, 2.2 Objectives of ATS**	X	X	X	X	X	X		
(02)	X	Describe the three basic types of ATS. ***Source:* ICAO Annex 11, Chapter 2, 2.3 Divisions of the air traffic services**	X	X	X	X	X	X		
(03)	X	Describe the three basic types of ATC services. ***Source:* ICAO Annex 11, Chapter 2, 2.3 Divisions of the air traffic services**	X	X	X	X	X	X		
(04)		State on which frequencies a pilot can expect ATC to contact them in case of an emergency. ***Source:* ICAO Annex 11, Chapter 2, 2.24 Service to aircraft in the event of an emergency, 2.25 In-flight contingencies, Chapter 5, 5.3 Use of communication facilities, and Chapter 6, 6.1.1.1 (referring to Annex 10, Volumes II and V), Chapter 4, 4.1.3.1**	X	X	X	X	X	X		
(05)		Describe the procedure for the transfer of an aircraft from one ATC unit to another. ***Source:* ICAO Annex 11, Chapter 3, 3.6.1 Transfer of responsibility for control**	X	X	X	X	X			
010 07 01 03		**Airspace**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the purpose for establishing flight information regions (FIRs) including upper flight information regions (UIRs). ***Source:* ICAO Annex 11, Chapter 2: 2.10; 2.11**	X	X	X	X	X	X		
(02)		Describe the various rules and services that apply to the various classes of airspace. ***Source:* ICAO Annex 11, Chapter 2, 2.6 Classification of airspaces and Annex 11, Appendix 4**	X	X	X	X	X	X	X	
(03)		**Explain which airspace shall be included in an FIR or UIR**	X	X	X	X	X	X		
(04)		State the designation for those portions of the airspace where flight information service (FIS) and alerting service shall be provided. ***Source:* ICAO Annex 11, Chapter 2, 2.5 Designation of the portions of the airspace and controlled aerodromes where air traffic services will be provided**	X	X	X	X	X	X		
(05)		State the designations for those portions of the airspace where ATC services shall be provided. ***Source:* ICAO Annex 11, Chapter 2, 2.5 Designation of the portions of the airspace and controlled aerodromes where air traffic services will be provided**	X	X	X	X	X	X		
(06)		Identify whether or not control areas (CTAs) and control zones (CTRs) designated within an FIR shall form part of that FIR.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 11, Chapter 2, 2.5 Designation of the portions of the airspace and controlled aerodromes where air traffic services will be provided**								
(07)		State the lower limit of a CTA as far as ICAO Standards are concerned. ***Source:* ICAO Annex 11, Chapter 2, 2.11.3 Control areas**	X	X	X	X	X	X		
(08)		State whether or not the lower limit of a CTA has to be established uniformly. ***Source:* ICAO Annex 11, Chapter 2, 2.11.3 Control areas**	X	X	X	X	X	X		
(09)		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. ***Source:* ICAO Annex 11, Chapter 2, 2.11 Specifications for flight information regions, control areas and control zones**	X	X	X	X	X	X		
(10)		Describe in general the lateral limits of CTRs. ***Source:* ICAO Annex 11, Chapter 2, 2.11.5 Control zones**	X	X	X	X	X	X		
(11)		State the minimum extension (in NM) of the lateral limits of a CTR. ***Source:* ICAO Annex 11, Chapter 2, 2.11.5 Control zones**	X	X	X	X	X	X		
(12)		State the upper limits of a CTR located within the lateral limits of a CTA. ***Source:* ICAO Annex 11, Chapter 2, 2.11.5 Control zones**	X	X	X	X	X	X		
010 07 01 04		**Air Traffic control (ATC) services**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Name all classes of airspace in which ATC services shall be provided. ***Source:* ICAO Annex 11, Chapter 3, 3.1 Application**	X	X	X	X	X	X		
(02)		Name the ATS units providing ATC services (area control service, approach control service, aerodrome control service). ***Source:* ICAO Annex 11, Chapter 3, 3.2 Provision of air traffic control service**	X	X	X	X	X	X	X	
(03)		Describe which unit(s) may be assigned with the task to provide specified services on the apron. ***Source:* ICAO Annex 11, Chapter 3, 3.2 Provision of air traffic control service**	X	X	X	X	X	X	X	
(04)		State the purpose of clearances issued by an ATC unit. ***Source:* ICAO Annex 11, Chapter 3, 3.3 Operation of air traffic control service**	X	X	X	X	X	X	X	
(05)		List the various (five possible) parts of an ATC clearance. ***Source:* ICAO Annex 11, Chapter 3, 3.7.1 Contents of clearances**	X	X	X	X	X	X	X	
(06)		Explain why the movement of persons, vehicles and towed aircraft on the manoeuvring area of an AD shall be controlled by the aerodrome control tower (TWR) (as necessary). ***Source:* ICAO Annex 11, Chapter 3, 3.8 Control of persons and vehicles at aerodromes, 3.8.1**	X	X	X	X	X	X		
010 07 01 05		**Flight information service (FIS)**								
(01)	X	State for which aircraft FIS shall be provided.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 11, Chapter 4, 4.1 Application**								
(02)	X	State whether or not FIS shall include the provision of pertinent significant meteorological information (SIGMET) and air meteorological information report (AIRMET) information. ***Source:* ICAO Annex 11, Chapter 4, 4.2 Scope of flight information service**	X	X	X	X	X	X		
(03)	X	State which information FIS shall include in addition to SIGMET and AIRMET information. ***Source:* ICAO Annex 11, Chapter 4, 4.2 Scope of flight information service**	X	X	X	X	X	X		
(04)	X	Indicate which other information the FIS shall include in addition to the special information given in Annex 11. ***Source:* ICAO Annex 11, Chapter 4, 4.2 Scope of flight information service, 4.2.2 Note 2 and Attachment B**	X	X	X	X	X	X		
(05)	X	State the meaning of the acronyms 'ATIS' in plain language. ***Source:* ICAO Annex 11, Chapter 4, 4.3.4 Voice-automatic terminal information service (Voice-ATIS) broadcasts**	X	X	X	X	X	X		
(06)		List the basic information concerning automatic terminal information service (ATIS) broadcasts (e.g. frequencies used, number of ADs included, updating, identification, acknowledgment of receipt, language and channels, ALT- setting). ***Source:* ICAO Annex 11, Chapter 4, 4.3.4 Voice-automatic terminal**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		information service (Voice-ATIS) broadcasts								
(07)		State the content of an ATIS message. **Source: ICAO Annex 11, Chapter 4, 4.3.7 ATIS for arriving and departing aircraft**	X	X	X	X	X			
(08)		State the reasons and circumstances when an ATIS message shall be updated. **Source: ICAO Annex 11, Chapter 4, 4.3.6 Automatic terminal information service (voice and/or data link)**	X	X	X	X	X	X		
010 07 01 06		**Alerting service**								
(01)		State who provides the alerting service. **Source: ICAO Annex 11, Chapter 2, 2.10 Establishment and designation of the units providing air traffic services**	X	X	X	X	X			
(02)		State who is responsible for initiating the appropriate emergency phase. ***Source:* ICAO Annex 11, Chapter 5 Alerting service**	X	X	X	X	X			
(03)		State the aircraft to which alerting service shall be provided. ***Source:* ICAO Annex 11, Chapter 5 Alerting service**	X	X	X	X	X			
(04)		State which unit shall be notified by the responsible ATS unit immediately when an aircraft is considered to be in a state of emergency. ***Source:* ICAO Annex 11, Chapter 5 Alerting service**	X	X	X	X	X			
(05)		Name the three stages of emergency and describe the basic conditions for each kind of emergency.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 11, Chapter 5 Alerting service**								
(06)		State the meaning of the expression 'INCERFA', 'ALERFA' and 'DETRESFA'. ***Source:* ICAO Annex 11, Chapter 5 Alerting service**	X	X	X	X	X			
(07)	X	State the information to be provided to those aircraft that operate in the vicinity of an aircraft that is either in a state of emergency or unlawful interference. ***Source:* ICAO Annex 11, Chapter 5 Alerting service**	X	X	X	X	X			
010 07 01 07		**Principles governing required navigation performance (RNP) and air traffic services (ATS) route designators**								
(01)		State the meaning of the acronym 'RNP'. ***Source:* ICAO Annex 11, Chapter 1 Definitions**								
(02)		State the factors that RNP is based on. ***Source:* ICAO Annex 11, Chapter 1 Definitions (Navigation specification)**	X	X	X	X	X			
(03)	X	Describe the reason for establishing a system of route designators and navigation specifications. ***Source:* ICAO Annex 11, Appendix 1, 1. Designators for ATS routes and navigation specifications**	X	X	X	X	X			
(04)		State whether or not a prescribed RNP type is considered an integral part of the ATS route designator. ***Source:* ICAO Annex 11, Appendix 1, 1. Designators for ATS routes and navigation specifications**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Explain the composition of an ATS route designator. ***Source:* ICAO Annex 11, Appendix 1, 2. Composition of designator (not to the extent of memorising the codes in 2.2.1)**	X	X	X	X	X			
010 07 02 00		**ICAO Doc 4444 – Air Traffic Management**								
010 07 02 01		**Foreword (Scope and purpose)**								
(01)		State which ATS units provide clearances that do, and do not, include the prevention of collision with terrain. ***Source:* ICAO Doc 4444, Foreword, 2 Scope and purpose, 2.1**	X	X	X	X	X	X	X	
010 07 02 02		**Definitions**								
(01)	X	Recall all definitions given in ICAO 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. ***Source:* ICAO Doc 4444, Chapter 1 Definitions**	X	X	X	X	X	X		
010 07 02 03		**ATS system capacity and air traffic flow management (AFTM)**								
(01)	X	Explain when and where ATFM services shall be implemented.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 3, 3.2 Air traffic flow management, 3.2.1 General**								
010 07 02 04		**General provisions for air traffic services (ATS)**								
(01)		State which information the issue of an ATC clearance is based on. ***Source:* ICAO Doc 4444, Chapter 4, 4.5 Air traffic control clearances, 4.5.1 Scope and purpose**	X	X	X	X	X	X	X	
(02)		Describe what a PIC should do if an ATC clearance is not suitable. ***Source:* ICAO Doc 4444, Chapter 4, 4.5 Air traffic control clearances, 4.5.1 Scope and purpose**	X	X	X	X	X	X	X	
(03)		State who bears the responsibility for adhering to the applicable rules and regulations whilst flying under the control of an ATC unit. ***Source:* ICAO Doc 4444, Chapter 4, 4.5 Air traffic control clearances, 4.5.1 Scope and purpose**	X	X	X	X	X	X	X	
(04)	X	State the two primary purposes of clearances issued by ATC units. ***Source:* ICAO Doc 4444, Chapter 4, 4.5 Air traffic control clearances, 4.5.1 Scope and purpose**	X	X	X	X	X	X		
(05)		State why clearances must be issued 'early enough' to aircraft. ***Source:* ICAO Doc 4444, Chapter 4, 4.5 Air traffic control**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		clearances, 4.5.1 Scope and purpose								
(06)		Explain what is meant by the expression 'clearance limit'. ***Source:* ICAO Doc 4444, Chapter 4, 4.5.7 Description of air traffic control clearances, 4.5.7.1 Clearance limit**	X	X	X	X	X	X	X	
(07)		Explain the meaning of the phrases 'cleared via flight planned route', 'cleared via (designation) departure' and 'cleared via (designation) arrival' in an ATC clearance. ***Source:* ICAO Doc 4444, Chapter 4, 4.5.7 Description of air traffic control clearances, 4.5.7.2 Route of flight**	X	X	X	X	X	X	X	
(08)		List which items of an ATC clearance shall always be read back by the flight crew. ***Source:* ICAO Doc 4444, Chapter 4, 4.5.7.5 Readback of clearances**	X	X	X	X	X	X	X	
010 07 02 06		**Horizontal speed control instructions**								
(01)		Explain the reason for speed control by ATC. ***Source:* ICAO Doc 4444, Chapter 4, 4.6 Horizontal speed control instructions, 4.6.1 General**	X	X	X	X	X	X	X	
(02)	X	Define the maximum speed changes that ATC may impose. ***Source:* ICAO Doc 4444, Chapter 4, 4.6.3 Descending and arriving aircraft**	X	X	X	X	X	X	X	
(03)		State within what distance from the THR the PIC should not expect any kind of speed control.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 4, 4.6.3 Descending and arriving aircraft**								
010 07 02 07		**Change from IFR to VFR flight**								
(01)		Explain how the change from IFR to VFR can be initiated by the PIC. ***Source:* ICAO Doc 4444, Chapter 4, 4.8 Change from IFR to VFR flight**	X		X			X	X	
(02)		Describe the expected reaction of the appropriate ATC unit upon a request to change from IFR to VFR. **Source: ICAOP Doc 4444, Chapter 4, 4.8 Change from IFR to VFR flight**	X		X			X	X	
010 07 02 08		**Wake turbulence**								
(01)		State the wake-turbulence categories of aircraft. ***Source:* ICAO Doc 4444, Chapter 4, 4.9.1 Wake turbulence categories of aircraft**	X	X	X	X	X	X		
(02)		State the wake-turbulence separation minima. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.8 Time-based wake turbulence longitudinal separation minima;** **ICAO Doc 4444, Chapter 8, 8.7.3.4 (table of distance-based wake turbulence separation minima) and 8.7.3.4.1 (appropriate conditions for application)**	X	X	X	X	X	X		
(03)		Describe how a 'heavy' aircraft shall indicate this in the initial radiotelephony contact with ATS. ***Source:* ICAO Doc 4444, Chapter 4, 4.9.2 Indication of heavy wake turbulence category**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 07 02 09		**Altimeter-setting procedures**								
(01)		Define the following terms: — TRL; — transition layer; and — TA. ***Source:* ICAO Doc 4444, Chapter 1 Definitions**	X	X	X	X	X	X		
(02)		Describe how the vertical position of an aircraft in the vicinity of an AD shall be expressed at or below the TA, at or above the TRL, and while climbing or descending through the transition layer. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.1 Expression of vertical position of aircraft**	X	X	X	X	X	X	X	
(03)		Describe when the HGT of an aircraft using QFE during an NDB approach is referred to the landing THR instead of the AD elevation. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.1 Expression of vertical position of aircraft**	X	X	X	X	X	X	X	
(04)		State in which margin altimeter settings provided to aircraft shall be rounded up or down. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.4 Provision of altimeter setting information**	X	X	X	X	X	X	X	
(05)		Describe the expression ‘lowest usable FL’. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.4 Provision of altimeter setting information**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Determine how the vertical position of an aircraft on an en-route flight is expressed at or above the lowest usable FL and below the lowest usable FL. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.1 Expression of vertical position of aircraft**	X	X	X	X	X	X	X	
(07)		State who establishes the TRL to be used in the vicinity of an AD. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.2 Determination of the transition level**	X	X	X	X	X	X	X	
(08)		Decide how and when a flight crew member shall be informed about the TRL. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.4 Provision of altimeter setting information**	X	X	X	X	X	X	X	
(09)		State whether or not the pilot can request TRL to be included in the approach clearance. ***Source:* ICAO Doc 4444, Chapter 4, 4.10.4 Provision of altimeter setting information**	X	X	X	X	X	X	X	
010 07 02 10		**Position reporting**								
(01)		Describe when position reports shall be made by an aircraft flying on routes defined by designated significant points. ***Source:* ICAO Doc 4444, Chapter 4, 4.11.1 Transmission of position reports, 4.11.1.1**	X	X	X	X	X	X	X	
(02)		List the six items that are normally included in a voice position report.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**								
(03)	X	State the requirements for using a simplified position report with FL, next position (and time-over) and ensuing significant points omitted. ***Source:* ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**	X	X	X	X	X	X	X	
(04)		State the item of a position report which must be forwarded on to ATC with the initial call after changing to a new frequency. ***Source:* ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**	X	X	X	X	X	X	X	
(05)		Indicate the item of a position report which may be omitted if secondary surveillance radar (SSR) Mode C is used. ***Source:* ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**	X	X	X	X	X	X	X	
(06)		Explain in which circumstances the airspeed should be included in a position report. ***Source:* ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**	X	X	X	X	X	X		
(07)		Explain the meaning of the acronyms 'ADS'.	X	X	X	X	X	X		
(08)		Describe which expression shall precede the level figures in a position report if the	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		level is reported in relation to 1013.2 hPa (standard pressure). ***Source:*** **ICAO Doc 4444, Chapter 4, 4.5.7.5 Readback of clearances;** **ICAO Doc 4444, Chapter 4, 4.11.2 Contents of voice position reports**								
010 07 02 11		**Reporting of operational and meteorological information**								
(01)		List the occasions when special air-reports shall be made. ***Source:*** **ICAO Doc 4444, Chapter 4, 4.12.3 Contents of special air-reports 4.12.3.1 (a to k inclusive)**	X	X	X	X	X	X		
010 07 02 12		**Separation methods and minima**								
(01)		Explain the general provisions for the separation of controlled air traffic. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.2.1 General and 5.2.2 Degraded aircraft performance**	X		X			X	X	
(02)	X	Name the different kinds of separation used in aviation. ***Source:*** **ICAO Doc 4444, Chapter 5;** **ICAO Annex 11, Chapter 3, 3.5.2**	X		X			X	X	
(03)		State the difference between the type of separation provided within the various classes of airspace and the various types of flight. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.2 Provisions for the separation of controlled traffic**	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		State who is responsible for the avoidance of collision with other aircraft when operating in VMC. ***Source:* ICAO Doc 4444, Chapter 5, 5.9 Clearances to fly maintaining own separation while in VMC**	X		X			X	X	
(05)		Describe how vertical separation is obtained. ***Source:* ICAO Doc 4444, Chapter 5, 5.3.1 Vertical separation application**	X		X			X	X	
(06)		State the required vertical separation minimum. ***Source:* ICAO Doc 4444, Chapter 5, 5.3.2 Vertical separation minimum**	X		X			X	X	
(07)		Describe how the cruising levels of aircraft flying to the same destination and in the expected approach sequence are correlated with each other. ***Source:* ICAO Doc 4444, Chapter 5, 5.3.3 Assignment of cruising levels for controlled flights**	X		X			X	X	
(08)		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. ***Source:* ICAO Doc 4444, Chapter 5, 5.3.4 Vertical separation during climb or descent**	X		X			X	X	
(09)		State the two main methods for horizontal separation. ***Source:* ICAO Doc 4444, Chapter 5**	X		X			X	X	
(10)		Describe how lateral separation of aircraft at the same level may be obtained.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: **ICAO Doc 4444, Chapter 5, 5.4.1 Lateral separation, 5.4.1.1.2**								
(11)		Explain the term ‘ geographical separation’. **Source: ICAO Doc 4444, Chapter 5, 5.4.1 Lateral separation**	X		X			X	X	
(12)		Describe track separation between aircraft using the same navigation aid or method. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.4.1.2 Lateral separation criteria and minima, 5.4.1.2.1.2**	X		X			X	X	
(13)		Describe the three basic means for the establishment of longitudinal separation. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.4.2**	X		X			X	X	
(14)		State the minimum standard horizontal radar separation in NM. ***Source:*** **ICAO Doc 4444, Chapter 5**	X		X			X	X	
(15)		Describe the method of the Mach number technique. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.4.2.4 Longitudinal separation minima with mach number technique based on time**	X	X						
010 07 02 13		**Separation in the vicinity of aerodromes (ADs)**								
(01)		Describe the expression ‘essential local traffic’. ***Source:*** **ICAO Doc 4444, Chapter 6, 6.2 Essential local traffic**	X	X	X	X	X	X		
(02)		State which possible decision the PIC may choose to take if they asked to accept take-off in a direction which is not ‘into the wind’.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 6, 6.3.3 Departure sequence**								
(03)		State the condition to enable ATC to initiate a visual approach for an IFR flight. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.3 Visual approach, 6.5.3.1**	X	X	X	X	X	X	X	
(04)		State whether or not separation shall be provided by ATC between an aircraft executing a visual approach and other arriving or departing aircraft. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.3 Visual approach, 6.5.3.4**	X	X	X	X	X	X	X	
(05)		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 given to them by ATC. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.4 Instrument approach**	X	X	X	X	X	X	X	
(06)		Describe which FL should be assigned to an aircraft first arriving over a holding fix for landing. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.5 Holding**	X	X	X	X	X	X	X	
(07)		State which kinds of priority can be applied to aircraft for a landing. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.6 Approach sequence, 6.5.6.1 General**	X	X	X	X	X	X	X	
(08)		Describe 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	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 6, 6.5.6 Approach sequence, 6.5.6.1 General**								
(09)		Explain the term 'expected approach time' and the procedures for its use. ***Source:* ICAO Doc 4444, Chapter 6, 6.5.7 Expected approach time**	X	X	X	X	X	X	X	
(10)		State the reasons which could probably lead to the decision to use another take-off or landing direction than the one into the wind. ***Source:* ICAO Doc 4444, Chapter 7, 7.2 Selection of runway-in-use**	X	X	X	X	X	X	X	
(11)		State the possible consequences for a PIC if the 'RWY-in-use' is not considered suitable for the operation involved. ***Source:* ICAO Doc 4444, Chapter 7**	X	X	X	X	X	X	X	
010 07 02 14		**Miscellaneous separation procedures**								
(01)		State the minimum separation between departing and arriving aircraft. ***Source:* ICAO Doc 4444, Chapter 5, 5.7 Separation of departing aircraft from arriving aircraft**	X	X	X	X	X	X	X	
(02)		State the non-radar wake-turbulence longitudinal separation minima. ***Source:* ICAO Doc 4444, Chapter 5 and 6**	X	X	X	X	X	X	X	
(03)		Describe the consequences of a clearance to 'maintain own separation' while in VMC. ***Source:*** **ICAO Doc 4444, Chapter 5, 5.8 Time-based wake turbulence**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		longitudinal separation minima, 5.8.1; **ICAO Doc 4444, Chapter 6, 6.5.3 Visual approach**								
(04)		Give a brief description of 'essential traffic' and 'essential traffic information'. **Source: ICAO Doc 4444, Chapter 5, 5.10 Essential traffic information**	X	X	X	X	X	X	X	
(05)		Describe the circumstances under which a reduction in separation minima may be allowed. ***Source:*** **ICAO Doc 4444, Chapter 6, 6.1 Reduction in separation minima in the vicinity of aerodromes**	X	X	X	X	X	X	X	
010 07 02 15		Arriving and departing aircraft								
(01)		List the elements of information which shall be transmitted to an aircraft as early as practicable if an approach for landing is intended. ***Source:*** **ICAO Doc 4444, Chapter 6, 6.6 Information for arriving aircraft**	X	X	X	X	X	X	X	
(02)		List the elements of information to be transmitted to an aircraft at the commencement of final approach. ***Source:*** **ICAO Doc 4444, Chapter 6, 6.6 Information for arriving aircraft**	X	X	X	X	X	X	X	
(03)		List the elements of information to be transmitted to an aircraft during final approach. ***Source:*** **ICAO Doc 4444, Chapter 6, 6.6 Information for arriving aircraft**	X	X	X	X	X	X	X	
(04)		State the prerequisites for operating on parallel or near-parallel RWYs including	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		the different combinations of parallel arrivals or departures. ***Source:* ICAO Doc 4444, Chapter 6, 6.7 Operations on parallel or near-parallel runways**								
(05)		State the sequence of priority between aircraft landing (or in the final stage of an approach to land) and aircraft intending to depart. ***Source:* ICAO Doc 4444, Chapter 7, 7.8 Order of priority for arriving and departing aircraft**	X	X	X	X	X	X	X	
(06)		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. ***Source:* ICAO Doc 4444, Chapter 6, 6.4.1 Meteorological conditions**	X	X	X	X	X	X	X	
(07)		State the significant changes that shall be transmitted as early as practicably possible to an arriving aircraft, particularly changes in the meteorological conditions. ***Source:* ICAO Doc 4444, Chapter 6, 6.6 Information for arriving aircraft**	X	X	X	X	X	X	X	
010 07 02 16		**Procedures for aerodrome (AD) control service**								
(01)		Name the operational failure or irregularity of AD equipment which shall be reported by the TWR immediately. ***Source:* ICAO Doc 4444, Chapter 7, 7.1.3 Failure or irregularity of aids and equipment**	X	X	X	X	X	X	X	
(02)		Explain that, after a given period of time, the TWR shall report to the area control	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		centre (ACC) or flight information centre (FIC) if an aircraft does not land as expected. ***Source:* ICAO Doc 4444, Chapter 7, 7.1.2 Alerting service provided by aerodrome control towers**								
(03)		Describe the procedures to be observed by the TWR whenever VFR operations are suspended. ***Source:* ICAO Doc 4444, Chapter 7, 7.13 Suspension of visual flight rules operations**	X	X	X	X	X	X	X	
(04)		Explain the term 'RWY-in-use' and its selection. ***Source:* ICAO Doc 4444, Chapter 7, 7.2 Selection of runway-in-use**	X	X	X	X	X			
(05)		List the information the TWR should give to an aircraft prior to: — taxiing for take-off; — take-off; — entering the traffic circuit. ***Source:* ICAO Doc 4444, Chapter 7, 7.4.1.2 Aerodrome and meteorological information**	X	X	X	X	X			
(06)		Explain that a report of surface wind direction given to a pilot by the TWR is magnetic. ***Source:* ICAO Doc 4444, Chapter 11, 11.4.3.2 Messages containing meteorological information**	X	X	X	X	X	X		
(07)		Explain the exact meaning of the expression 'RWY vacated'.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 7, 7.10.3.4**								
010 07 02 17		**Radar services**								
(01)		State the basic identification procedures used with radar. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.2.3 SSR and/or MLAT identification procedures and Chapter 8, 8.6.2.4 PSR identification procedures**	X	X	X	X	X	X	X	
(02)		Define the term 'PSR'. **Doc 4444, Chapter 1 Definitions**	X	X	X	X	X	X	X	
(03)		Describe the circumstances under which an aircraft provided with radar service should be informed of its position. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.4 Position information**	X	X	X	X	X	X	X	
(04)		List the possible forms of position information passed on to the aircraft by radar services. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.4 Position information**	X	X	X	X	X	X	X	
(05)		Describe the term 'radar vectoring'. **Source: ICAO Doc 4444, Chapter 8, 8.6.5 Vectoring**	X	X	X	X	X	X	X	
(06)		State the aims of radar vectoring as shown in ICAO Doc 4444. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.5 Vectoring**	X	X	X	X	X	X	X	
(07)		Describe how radar vectoring shall be achieved. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.5 Vectoring**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Describe the information which shall be given to an aircraft when radar vectoring is terminated and the pilot is instructed to resume own navigation. ***Source:* ICAO Doc 4444, Chapter 8, 8.6.5 Vectoring**	X	X	X	X	X	X	X	
(09)		Explain the procedures for the conduct of surveillance radar approaches (SRAs). ***Source:* ICAO Doc 4444, Chapter 8, 8.9.7.1 Surveillance radar approach**	X	X	X	X	X	X	X	
(10)		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. ***Source:* ICAO Doc 4444, Chapter 8, 8.8.1 Emergencies**	X	X	X	X	X	X	X	
010 07 02 18		**Air traffic advisory services**								
(01)		Describe the objective and basic principles of the air traffic advisory service. ***Source:* ICAO Doc 4444, Chapter 9, 9.1.4.1 Objective and basic principles**	X	X	X	X	X	X		
(02)		State to which aircraft air traffic advisory service may be provided. ***Source:* ICAO Doc 4444, Chapter 9, 9.1.4.1 Objective and basic principles**	X	X	X	X	X	X		
(03)		Explain the difference between advisory information and clearances, stating which ATS units are responsible for their issue. ***Source:* ICAO Doc 4444, Chapter 9, 9.1.4.1.3**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 07 02 19		**Procedures related to emergencies, communication (COM) and contingencies**								
(01)		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. ***Source:* ICAO Doc 4444, Chapter 15, 15.1 Emergency procedures**	X	X	X	X	X	X	X	
(02)		State the special rights an aircraft in a state of emergency can expect from ATC. ***Source:* ICAO Doc 4444, Chapter 15, 15.1.1 General; 15.1.2 Priority; 15.1.3 Unlawful interference and aircraft bomb threat**	X	X	X	X	X	X	X	
(03)		Describe the expected action of aircraft after receiving a broadcast from ATS concerning the emergency descent of an aircraft. ***Source:* ICAO Doc 4444, Chapter 15, 15.1.4 Emergency descent**	X	X	X	X	X	X	X	
(04)		State how it can be ascertained, in case of a failure of two-way COM, whether the aircraft is able to receive transmissions from the ATS unit. ***Source:* ICAO Doc 4444, Chapter 15, 15.3 Air-ground communications failure**	X	X	X	X	X	X	X	
(05)		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	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Doc 4444, Chapter 15, 15.3.5**								
(06)		State what is meant by the expression 'stayed aircraft'. ***Source:* ICAO Doc 4444, Chapter 15, 15.5.1 Strayed or unidentified aircraft**	X	X	X	X	X	X	X	
(07)		Explain the reasons for fuel-dumping and state the minimum level. ***Source:* ICAO Doc 4444, Chapter 15, 15.5.3 Fuel dumping**	X	X	X	X	X	X		
(08)		Explain the possible request of ATC to an aircraft to change its radio-telephone (RTF) call sign.	X	X	X	X	X	X		
010 07 02 20		**Miscellaneous procedures**								
(01)		Explain the meaning of 'AIRPROX'. ***Source:*** **ICAO Doc 4444, Chapter 1 Definitions;** **ICAO Doc 4444, Chapter 16, 16.3 Air traffic incident report**	X	X	X	X	X	X		
(02)		Describe the task of an air traffic incident report. ***Source:* ICAO Doc 4444, Chapter 16, 16.3 Air traffic incident report**	X	X	X	X	X	X		
010 08 00 00		**AERONAUTICAL INFORMATION SERVICE (AIS)**								
010 08 01 00		**Introduction**								
010 08 01 01		**Introduction to ICAO Annex 15 – Aeronautical Information Services (AIS)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State, in general terms, the objective of an AIS. ***Source:* ICAO Annex 15, Chapter 1, Note 1**	X	X	X	X	X	X		
010 08 02 00		**Definitions of ICAO Annex 15**								
010 08 02 01		**Definitions of ICAO Annex 15**								
(01)		Recall the following definitions: aeronautical information circular (AIC), aeronautical information publication (AIP), AIP amendment, AIP supplement, aeronautical information regulation and control (AIRAC), danger area, aeronautical information management, international airport, international NOTAM office (NOF), manoeuvring area, movement area, NOTAM, pre-flight information bulletin (PIB), prohibited area, restricted area, SNOWTAM, ASHTAM. ***Source:* ICAO Annex 15, Chapter 1, 1.1 Definitions**	X	X	X	X	X	X	X	
010 08 03 00		**General**								
010 08 03 01		**General – AIS responsibilities and functions**								
(01)		State during which period of time an AIS 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. ***Source:* ICAO Annex 15, Chapter 2, 2.2 AIS responsibilities and functions**	X	X	X	X	X	X		
(02)		List, in general, the kind of aeronautical information/data which an AIS service shall make available in a suitable form to flight crew.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 15, Chapter 2, 2.2 AIS responsibilities and functions**								
(03)		Summarise the duties of an AIS concerning aeronautical information data for the territory of a particular State. ***Source:*** **ICAO Annex 15, Chapter 2, 2.2 AIS responsibilities and functions;** **ICAO Annex 15, Chapter 2, 2.3 Exchange of aeronautical data and aeronautical information**	X	X	X	X	X	X		
010 08 04 00		**Aeronautical information products and services**								
010 08 04 01		**Aeronautical information publication (AIP)**								
(01)		State the primary purpose of the AIP. ***Source:* ICAO Annex 15, Chapter 5, 5.2.2, Notes 1 and 2**	X	X	X	X	X	X		
(02)		Name the different parts of the AIP. ***Source:* ICAO Annex 15, Chapter 5, 5.2.1, Note 1; PANS-AIM (ICAO Doc 10066), Chapter 5, 5.2.1.2.5**	X	X	X	X	X	X		
(03)		State the main parts of the AIP where the following information can be found: — differences from the ICAO Standards, Recommended Practices and Procedures; — location indicators, AIS, minimum flight ALT, meteorological information for aircraft in flight (VOLMET) service, SIGMET service; — general rules and procedures (especially general rules, VFR, IFR, ALT-setting procedure, interception of civil	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		aircraft, unlawful interference, air traffic incidents); — ATS airspace (especially FIR, UIR, TMA); — ATS routes (especially lower ATS routes, upper ATS routes, area navigation routes); — AD data including aprons, taxiways (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, approach (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, and the significance of this information to flight crew. ***Source:* ICAO Annex 15, Chapter 5, 5.2.1, Note 1; PANS-AIM (ICAO Doc 10066), Appendix 2**								
(04)		State how permanent changes to the AIP shall be published. ***Source:* ICAO Annex 15, Chapter 5, 5.4 Distribution services and Chapter 6, 6.3.1 AIP updates, 6.3.1.2; PANS-AIM (ICAO Doc 10066), Chapter 5, 5.2.1**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Aeronautical Information Publication (AIP), 5.2.1.3, 5.4 Distribution services, Chapter 6, 6.1.2 Specifications for AIP amendments								
(05)		Explain what kind of information shall be published in the form of AIP Supplements. ***Source:* ICAO Annex 15, Chapter 6, 6.3.1 AIP updates, 6.3.1.3; PANS-AIM (ICAO Doc 10066), Chapter 5, 5.2.1.4 Specifications for AIP Supplements**	X	X	X	X	X	X		
010 08 04 02		**Notices to airmen (NOTAMs)**								
(01)		Describe how information shall be published which in principle would belong to NOTAMs but includes extensive text or graphics. ***Source:* ICAO Annex 15, Chapter 6, 6.3.1.3, 6.3.2.1 and 6.3.2.2**	X	X	X	X	X	X	X	
(02)		Summarise the essential information which leads to the issue of a NOTAM. ***Source:* ICAO Annex 15, Chapter 6, 6.3.2.3**	X	X	X	X	X	X	X	
(03)		State how NOTAMs shall be distributed. ***Source:* ICAO Annex 15, Chapter 5.4.2**	X	X	X	X	X	X		
(04)		Explain how information regarding snow, ice and standing water on AD pavements shall be reported. ***Source:* ICAO Annex 15, Chapter 5, 5.2.6 Note; PANS-AIM (ICAO Doc 10066), Appendix 4 Instructions for the completion of the SNOWTAM format**	X	X	X	X	X	X	X	
(05)		Describe the means by which NOTAMs shall be distributed. ***Source:***	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		ICAO Annex 15, Chapter 5, 5.4 Distribution services; PANS-AIM (ICAO Doc 10066), 5.2.5 NOTAM, 5.2.5.1.3, and Appendix 7								
(06)		Define and state which information an ASHTAM may contain. ***Source:*** **ICAO Annex 15, Chapter 5, 5.2.6 Note; PANS-AIM (ICAO Doc 10066), Appendix 5 ASHTAM format**	X	X	X	X	X	X		
010 08 04 03		**Aeronautical information regulation and control (AIRAC)**								
(01)	X	List the circumstances under which the information concerned shall or should be distributed as an AIRAC. ***Source:*** **ICAO Annex 15, Chapter 6, 6.2**	X	X	X	X	X	X	X	
(02)		Explain the organisation of AICs. ***Source:*** **ICAO Annex 15, Chapter 5, 5.2.4, Note; PANS-AIM (ICAO Doc 10066), Chapter 5, 5.2.2 Aeronautical Information Circulars (AIC), 5.2.2.3 to 5.2.2.9**	X	X	X	X	X	X		
010 08 04 05		**Pre-flight and post-flight information/data**								
(01)		Summarise, in addition to the elements of the integrated AIP and maps/charts, the additional current information relating to the AD of departure that shall be provided as pre-flight information. ***Source:*** **ICAO Annex 15, Chapter 5, 5.5 Pre-flight information service; PANS-AIM (ICAO Doc 10066), Chapter 5, 5.5 Pre-flight information services**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe how a recapitulation of current NOTAM and other information of urgent character shall be made available to flight crew. ***Source:* ICAO Annex 15, Chapter 5, 5.5 Pre-flight information service, Note 2**	X	X	X	X	X	X	X	
(03)		State which post-flight information from flight crew shall be submitted to AIS for distribution as required by the circumstances. ***Source:* ICAO Annex 15, Chapter 5, 5.6 Post-flight information service**	X	X	X	X	X	X		
010 08 05 00		**ATM service providers**								
010 08 05 01		**ATM**								
(01)		State that Commission Implementing Regulation (EU) 2017/373 provides: — general requirements for the provision of air navigation services; — specific requirements for the provision of air traffic services; — specific requirements for the provision of meteorological services; — specific requirements for the provision of aeronautical information services; — specific requirements for the provision of communication, navigation or surveillance services.	X		X	X				
010 09 00 00		**AERODROMES (ICAO Annex 14, Volume I — Aerodrome Design and Operations, and Regulation (EU) No 139/2014)**								
010 09 01 00		**General**								
010 09 01 01		**General – AD reference code**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the intent of the AD reference code and state the functions of the two code elements. ***Source:* ICAO Annex 14, Volume 1, Chapter 1, 1.6 Reference Code**	X	X						
010 09 02 00		**Aerodrome (AD) data**								
010 09 02 01		**Aerodrome (AD) reference point**								
(01)		Describe where the AD reference point shall be located and where it shall normally remain. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.2 Aerodrome reference point**	X	X	X	X	X	X	X	
010 09 02 02		**Pavements strengths**								
(01)		Explain the terms: 'pavement classification number (PCN)' and 'aircraft classification number (ACN)', and describe their mutual dependence. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.6 Strength of pavements**	X	X	X	X	X	X		
(02)		Describe how the bearing strength for an aircraft with an apron mass equal to or less than 5 700 kg shall be reported. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.6 Strength of pavements**	X	X	X	X	X	X		
010 09 02 03		**Declared distances**								
(01)		State that ICAO Annex 14 provides guidance on the calculation of declared distances (TORA, TODA, ASDA, LDA).	X	X	X	X	X	X		
(02)		Recall the definitions for the four main declared distances. ***Source:* ICAO Annex 14, Volume 1, Chapter 1, 1.1 Definitions**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 09 02 04		**Condition of the movement area and related facilities**								
(01)		State the purpose of informing AIS and ATS units about the condition of the movement area and related facilities. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.9 Condition of the movement area and related facilities**	X	X	X	X	X	X		
(02)		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. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.9 Condition of the movement area and related facilities**	X	X	X	X	X	X(		
(03)		Describe the three different types of water deposit on RWYs. ***Source:* ICAO Annex 14, Volume 1, Chapter 2, 2.9 Condition of the movement area and related facilities**	X	X	X	X	X	X		
(04)		Explain the different types of frozen water on the RWY and their impact on aircraft braking performance. ***Source:* ICAO Annex 14, Volume 1, Chapter 1, 1.1 Definitions and Chapter 2, 2.9 Condition of the movement area and related facilities**	X	X	X	X	X	X		
(05)		Describe the five levels of braking action including the associated coefficients and codes. ***Source:* ICAO Annex 14, Volume 1, Attachment A, 6. Assessing the surface friction characteristics of snow-, slush-, ice- and frost-covered paved surfaces**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 09 03 00		**Physical characteristics**								
010 09 03 01		**Runways (RWYs)**								
(01)		Describe where a THR should normally be located. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.1.5 and 3.1.6 Location of threshold**	X	X	X	X	X	X		
(02)		Describe the general considerations concerning RWYs associated with a stopway (SWY) or clearway (CWY). ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.1.9 Runways with stopways or clearways**	X	X	X	X	X	X	X	
010 09 03 02		**Runway (RWY) strips**								
(01)		Explain the term 'runway strip'. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.4 General, 3.4.1**	X	X	X	X	X	X	X	
010 09 03 03		**Runway-end safety area**								
(01)		Explain the term 'runway-end safety area'. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.5 Runway end safety area 3.5.1 and 3.5.2**	X	X	X	X	X	X	X	
010 09 03 04		**Clearway (CWY)**								
(01)		Explain the term 'clearway'. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.6 Clearways**	X	X	X	X	X	X	X	
010 09 03 05		**Stopway (SWY)**								
(01)		Explain the term 'stopway'. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.7 Stopways**	X	X	X	X	X	X	X	
010 09 03 06		**Intentionally left blank**								
010 09 03 07		**Taxiways (TWYs)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the reasons and the requirements for rapid-exit TWYs. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.9 Taxiways – Rapid-exit taxiways**	X	X	X	X	X	X		
(02)		Explain TWY widening in curves. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.9.5 Taxiways curves**	X	X	X	X	X	X		
(03)		Explain when and where holding bays should be provided. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.12**	X	X	X	X	X	X		
(04)		Describe where RWY holding positions shall be established. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.12**	X	X	X	X	X	X	X	
(05)		Describe the term 'road holding position'. ***Source:* ICAO Annex 14, Volume 1, Chapter 1, 1.1 and Chapter 3, 3.12**	X	X	X	X	X	X		
(06)		Describe where intermediate TWY holding positions should be established. ***Source:* ICAO Annex 14, Volume 1, Chapter 3, 3.12**	X	X	X	X	X	X		
010 09 04 00		**Visual aids for navigation**								
010 09 04 01		**Indicators and signalling devices**								
(01)		Describe the wind-direction indicators with which ADs shall be equipped. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.1.1 Wind direction indicator (Application, Location and Characteristics)**	X	X	X	X	X	X	X	
(02)		Describe a landing-direction indicator .	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.1.2 Landing direction indicator**								
(03)		Explain the capabilities of a signalling lamp.	X	X	X	X	X	X	X	
(04)	X	State which characteristics a signal area should have. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.1.4 Signal panels and signal area, 5.1.4.1 to 5.1.4.3**	X	X	X	X	X	X	X	
(05)	X	Interpret all indications and signals that may be used in a signal area. ***Source:* Commission Implementing Regulation (EU) No 923/2012 (SERA) — Appendix 1 Signals, 3.2 Visual ground signals**	X	X	X	X	X	X	X	
010 09 04 02		**Markings**								
(01)		Name the colours used for the various markings (RWY, TWY, aircraft stands, apron safety lines). ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.2 Markings**	X	X	X	X	X	X	X	
(02)		State where a RWY designation marking shall be provided and describe the different layouts (excluding dimensions). ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.2 Markings**	X	X	X	X	X	X	X	
(03)		Describe the application and general characteristics (excluding dimensions) of: — RWY-centre-line markings; — THR markings; — touchdown-zone (TDZ) markings; — RWY-side-stripe markings; — TWY-centre-line markings;	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— RWY holding position markings; — intermediate holding position markings; — aircraft-stand markings; — apron safety lines; — road holding position markings; — mandatory instruction markings; — information markings. *Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.2 Markings								
010 09 04 03		Lights								
(01)		Describe the mechanical safety considerations regarding elevated approach lights and elevated RWY, SWY and TWY lights. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.3.1.4 to 5.3.1.8 (Elevated approach lights, elevated lights and surface lights)**	X	X	X	X	X	X	X	
(02)		List the conditions for the installation of an aerodrome beacon (ABN) and describe its general characteristics. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.3.3 Aeronautical beacons**	X	X	X	X	X	X	X	
(03)		Describe the different kinds of operations for which a simple approach lighting system shall be used. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.3.4 Approach lighting systems**	X	X	X	X	X	X	X	
(04)		Describe the basic installations of a simple approach lighting system including the dimensions and distances normally used. ***Source:* ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.2**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe the principle of a precision approach category I lighting system including information such as location and characteristics. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.10;** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.14**	X	X	X	X	X	X	X	
(06)		Describe the principle of a precision approach category II and III lighting system including information such as location and characteristics, especially the inner 300 m of the system. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.22;** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.30;** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.4.31**	X					X	X	
(07)		Describe the wing bars of the precision approach path indicator (PAPI) and the abbreviated precision approach path indicator (APAPI). Interpret what the pilot will see during the approach using PAPI. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 5, 5.3.5.24 to 5.3.5.27 PAPI and APAPI**	X	X	X	X	X	X	X	
(08)		Interpret what the pilot will see during an approach using a helicopter approach path indicator (HAPI).			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 14, Volume II, Chapter 5, 5.3.6 Visual approach slope indicator**								
(09)		Explain the application and characteristics (as applicable, but limited to colour, intensity, direction and whether fixed or flashing) of: — RWY-edge lights; — RWY-THR and wing-bar lights; — RWY-end lights; — RWY-centre-line lights; — RWY-lead-in lights; — RWY-TDZ lights; — SWY lights; — TWY-centre-line lights; — TWY-edge lights; — stop bars; — intermediate holding position lights; — RWY guard lights; — road holding position lights. ***Source:* ICAO Annex 14, Volume 1, Chapter 5**	X	X	X	X	X	X	X	
(10)		State the timescale within which aeronautical ground lights shall be made available to arriving aircraft. ***Source:* ICAO Doc 4444, Section 7.15 Aeronautical ground lights**	X	X	X	X	X	X	X	
010 09 04 04		**Signs**								
(01)		Explain which signs are the only ones on the movement area utilising red. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(02)		List the provisions for illuminating signs.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**								
(03)		Name the kinds of signs which shall be included in mandatory instruction signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(04)		Name the colours used for mandatory instruction signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(05)		Describe by which sign a pattern 'A' RWY holding position (i.e. at an intersection of a TWY and a non-instrument, non-precision approach or take-off RWY) marking shall be supplemented. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(06)		Describe by which sign a pattern 'B' RWY holding position (i.e. at an intersection of a TWY and a precision approach RWY) marking shall be supplemented. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(07)		Describe the location of: — a RWY designation sign at a TWY/RWY intersection; — a 'NO ENTRY' sign; — a RWY holding position sign. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(08)		State which sign indicates that a taxiing aircraft is about to infringe an obstacle limitation surface or interfere with the	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		operation of radio navigation aids (e.g. ILS/MLS critical/sensitive area). ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**								
(09)		Describe the various possible inscriptions on RWY designation signs and on holding position signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(10)		Describe the colours used in connection with information signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(11)		Describe the possible inscriptions on information signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(12)		Explain the application, location and characteristics of aircraft stand identification signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
(13)		Explain the application, location and characteristics of road holding position signs. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.4 Signs**	X	X	X	X	X	X	X	
010 09 04 05		**Markers**								
(01)		Explain why markers located near a RWY or TWY shall be HGT limited. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.5 Markers**	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the application and characteristics (excluding dimensions) of: — unpaved RWY-edge markers; — TWY-edge markers; — TWY-centre-line markers; — unpaved TWY-edge markers; — boundary markers; — SWY-edge markers. ***Source:* ICAO Annex 14, Volume 1, Chapter 5.5 Markers**	X	X	X	X	X	X	X	
010 09 05 00		**Visual aids for denoting obstacles**								
010 09 05 01		**Marking of subjects**								
(01)		State how fixed or mobile objects shall be marked if colouring is not practicable. ***Source:* ICAO Annex 14, Volume 1, Chapter 6, 6.2.3.1 Marking**	X	X	X	X	X	X		
(02)		Describe marking by colours (fixed or mobile objects). ***Source:*** **ICAO Annex 14, Volume 1, Chapter 6, 6.2.2 Mobile objects: 6.2.2.1, 6.2.2.2; 6.2.2.3; 6.2.2.4;** **ICAO Annex 14, Volume 1, Chapter 6, 6.2.3 Fixed objects: 6.2.3.1; 6.2.3.2; 6.2.3.3**	X	X	X	X	X	X		
(03)		Explain the use of markers for the marking of objects, overhead wires, cables, etc. ***Source:* ICAO Annex 14, Volume 1, Chapter 6, 6.2.5 Overhead wires, cables, etc., and supporting towers**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain the use of flags for the marking of objects. ***Source:* ICAO Annex 14, Volume 1, Chapter 6, 6.2.3 Fixed objects: 6.2.3.5; 6.2.3.6; 6.2.3.7**	X	X	X	X	X	X		
010 09 05 02		**Lighting of subjects**								
(01)		Name the different types of lights to indicate the presence of objects which must be lighted. ***Source:* ICAO Annex 14, Volume 1, Chapter 6, 6.2 Marking and/or lighting of objects: 6.2.1.1**	X	X	X	X	X	X		
(02)		Describe (in general terms) the location of obstacle lights. ***Source:* ICAO Annex 14, Volume 1, Chapter 6, 6.2 Marking and/or lighting of objects: 6.2.1.3**	X	X	X	X	X	X		
(03)		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. ***Source:* ICAO Annex 14, Volume 1, Chapter 6: Table 6-1. Characteristics of obstacle lights**	X	X	X	X	X	X		
(04)		State that information about lights to be displayed by aircraft is provided in both ICAO Annex 2 (Rules of the Air) and SERA.	X	X	X	X	X	X		
010 09 06 00		**Visual aids for denoting restricted use of areas**								
010 09 06 01		**Visual aids for denoting restricted use of areas on RWYs and TWYs**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the colours and meaning of 'closed markings' on RWYs and TWYs. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 7, 7.1 Closed runways and taxiways, or parts thereof**	X	X	X	X	X	X		
(02)		State how the pilot of an aircraft moving on the surface of a TWY, holding bay or apron shall warned that the shoulders of these surfaces are 'non-load-bearing'. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 7, 7.2 Non-load-bearing surfaces**	X	X	X	X	X	X		
(03)		Describe the pre-THR marking (including colours) when the surface before the THR is not suitable for normal use by aircraft. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 7, 7.3 Pre-threshold area**	X	X	X	X	X	X		
010 09 07 00		**Aerodrome (AD) operational services, equipment and installations**								
010 09 07 01		**Rescue and firefighting (RFF)**								
(01)		State the principal objective of RFF services. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 9, 9.2 Rescue and firefighting**	X	X	X	X	X	X		
(02)		Explain the basic information the AD category (for RFF) depends upon. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 9, 9.2 Rescue and firefighting**	X	X	X	X	X	X		
(03)		Describe what is meant by the term 'response time', and state its normal and maximum limits. ***Source:*** **ICAO Annex 14, Volume 1, Chapter 9, 9.2 Rescue and firefighting**	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
010 09 07 02		**Apron management service**								
(01)		State who has a right-of-way against vehicles operating on an apron. ***Source:* ICAO Annex 14, Volume 1, Chapter 9, 9.5 Apron management service**	X	X	X	X	X	X		
010 09 07 03		**Ground-servicing of aircraft**								
(01)		Describe the necessary actions during the ground-servicing of an aircraft with regard to the possible event of a fuel fire. ***Source:* ICAO Annex 14, Volume 1, Chapter 9, 9.6 Ground servicing of aircraft**	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**								
(01)		List the four types of 'declared distances' on a RWY and also the appropriate abbreviations. ***Source:* ICAO Annex 14, Volume 1, Attachment A, 3. Calculation of declared distances: 3.1**	X	X	X	X	X	X		
(02)		Explain the circumstances which lead to the situation that the four declared distances on a RWY are equal to the length of the RWY. ***Source:* ICAO Annex 14, Volume 1, Attachment A, 3. Calculation of declared distances: 3.2**	X	X	X	X	X	X		
(03)		Describe the influence of a CWY, SWY or displaced THR upon the four 'declared disatnces'.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 14, Volume 1, Attachment A, 3. Calculation of declared distances: 3.3; 3.4; 3.5**								
010 09 08 02		**Intentionally left blank**								
010 09 08 03		**Approach lighting systems**								
(01)		Name the two main groups of approach lighting systems. ***Source:* ICAO Annex 14, Volume 1, Attachment A, 12.1 Types and characteristics**	X	X	X	X	X	X	X	
(02)		Describe the two different versions of a simple approach lighting system.	X	X	X	X	X	X	X	
(03)		Describe the two different basic versions of precision approach lighting systems for CAT I.	X	X	X	X	X	X	X	
(04)		Describe the diagram of the inner 300 m of the precision approach lighting system in the case of CAT II and III.	X							
(05)		Describe how the arrangement of an approach lighting system and the location of the appropriate THR are interrelated.	X	X	X	X	X	X	X	
010 10 00 00		**FACILITATION (ICAO Annex 9)**								
010 10 01 00		**Intentionally left blank**								
010 10 02 00		**Entry and departure of aircraft**								
010 10 02 01		**General declaration**								
(01)		Describe the purpose and use if aircraft documents as regards a 'general declaration'. ***Source:* ICAO Annex 9, Chapter 2 Entry and departure of aircraft, Section B Documents — requirements and use and Section D Disinsection of aircraft**	X	X	X	X	X			
010 10 02 02		**Entry and departure of crew**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain entry requirements for crew. ***Source:* ICAO Annex 9, Chapter 3, K. Entry procedures and responsibilities; N. Identification and entry of crew and other aircraft operators' personnel**	X	X	X	X	X			
(02)		Explain the reasons for the use of crew member certificates (CMC) for crew members engaged in international air transport. ***Source:* ICAO Annex 9, Chapter 3, N. Identification and entry of crew and other aircraft operators' personnel**	X	X	X	X	X			
(03)		Explain in which cases Contracting States should accept the CMC as an identity document instead of a passport or visa. ***Source:* ICAO Annex 9, Chapter 3, N. Identification and entry of crew and other aircraft operators' personnel**	X	X	X	X	X			
010 10 02 03		**Entry and departure of passengers and their baggage**								
(01)		Explain the entry requirements for passengers and their baggage. ***Source:* ICAO Annex 9, Chapter 3 Entry and departure of persons and their baggage:** **A. General;** **B. Documents required for travel;** **F. Entry/re-entry visas;** **P. Emergency assistance/entry visas in cases of force majeure**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the requirements and documentation for unaccompanied baggage. ***Source:*** **ICAO Annex 9, Chapter 3, M. Disposition of baggage separated from its owner;** **ICAO Annex 9, Chapter 4, C. Release and clearance of export and import cargo**	X	X	X	X	X			
(03)		Identify the documentation required for the departure and entry of passengers and their baggage. ***Source:*** **ICAO Annex 9, Chapter 3. Entry and departure of persons and their baggage**	X	X	X	X	X			
(04)		Explain the arrangements in the event of a passenger being declared an inadmissible person. ***Source:*** **ICAO Annex 9, Chapter 5, INADMISSIBLE PERSONS AND DEPORTEES: A. General; B. Inadmissible persons**	X	X	X	X	X			
(05)		Describe the pilot's authority towards unruly passengers. ***Source:*** **ICAO Annex 9, Chapter 6, E. Unruly passengers**	X	X	X	X	X			
010 10 02 04		**Entry and departure of cargo**								
(01)		Explain the entry requirements for cargo.	X	X	X	X	X			
010 11 00 00		**SEARCH AND RESCUE (SAR)**								
010 11 01 00		**Essential SAR definitions**								
010 11 01 01		**Essential SAR definitions – ICAO Annex 12**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Recall the definitions of the following terms: alert phase, distress phase, emergency phase, operator, PIC, rescue coordination centre, State of Registry, uncertainty phase. ***Source:* ICAO Annex 12, Chapter 1 Definitions**	X	X	X	X	X			
010 11 02 00		**SAR – Organisation**								
010 11 02 01		**SAR – Organisation – Establishment and provision**								
(01)		Describe how ICAO Contracting States shall arrange for the establishment and prompt provision of SAR services. ***Source:* ICAO Annex 12, Chapter 2**	X	X	X	X	X			
(02)		Explain the establishment of SAR by Contracting States. ***Source:* ICAO Annex 12, Chapter 2**	X	X	X	X	X			
(03)		Describe the areas within which SAR services shall be established by Contracting States. ***Source:* ICAO Annex 12, Chapter 2**	X	X	X	X	X			
(04)		State the period of time per day within which SAR services shall be available. ***Source:* ICAO Annex 12, Chapter 2**	X	X	X	X	X			
(05)		Describe for which areas rescue coordination centres shall be established. ***Source:* ICAO Annex 12, Chapter 2**	X	X	X	X	X			
010 11 03 00		**Operating procedures for non-SAR crews**								
010 11 03 01		**Operating procedures for non-SAR crews – PIC**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the SAR operating procedures for the PIC who arrives first at the scene of an accident. ***Source:* ICAO Annex 12, Chapter 5, 5.6 Procedures at the scene of an accident**	X	X	X	X	X			
(02)		Explain the SAR operating procedures for the PIC intercepting a distress transmission. ***Source:* ICAO Annex 12, Chapter 5, 5.7 Procedures for a pilot-in-command intercepting a distress transmission**	X	X	X	X	X			
010 11 04 00		**Search and rescue signals**								
010 11 04 01		**Search and rescue signals – Survivors**								
(01)		Explain the 'ground-air visual signal code' for use by survivors. ***Source:* ICAO Annex 12, Chapter 5.8 Search and rescue signals and Appendix**	X	X	X	X	X			
(02)		Recognise the SAR 'air-to-ground signals' for use by survivors. ***Source:* ICAO Annex 12, Chapter 5.8 Search and rescue signals and Appendix**	X	X	X	X	X			
010 12 00 00		**SECURITY — Safeguarding International Civil Aviation against Acts of Unlawful Interference (ICAO Annex 17)**								
010 12 01 00		**Essential definitions of ICAO Annex 17**								
010 12 01 01		**Essential definitions of ICAO Annex 17**								
(01)		Recall the definitions of the following terms:	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		airside, aircraft security check, screening, security, security control, security-restricted area, unidentified baggage. ***Source:* ICAO Annex 17, Chapter 1 Definitions**								
010 12 02 00		**General principles**								
010 12 02 00		**General principles – objectives of security**								
(01)		State the objectives of security. ***Source:* ICAO Annex 17, Chapter 2, 2.1 Objectives**	X	X	X	X	X			
010 12 03 00		**Intentionally left blank**								
010 12 04 00		**Preventative security measures**								
010 12 04 01		**Preventative security measures**								
(01)		Describe the objects not allowed (for reasons of aviation security) on board an aircraft that is engaged in international civil aviation. ***Source:* ICAO Annex 17, Chapter 4, 4.1 Objective**	X	X	X	X	X			
(02)		State what each Contracting State is supposed to do if passengers subjected to security control have mixed after a security screening point. ***Source:* ICAO Annex 17, Chapter 4, 4.4 Measures relating to passengers and their cabin baggage**	X	X	X	X	X			
(03)		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			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		***Source:* ICAO Annex 17, Chapter 4, 4.7 Measures relating to special categories of passengers**								
(04)		Explain what has to be considered if law enforcement officers carry weapons on board. ***Source:* ICAO Annex 17, Chapter 4, 4.7 Measures relating to special categories of passengers**	X	X	X	X	X			
010 12 05 00		**Management of response to acts of unlawful interference**								
010 12 05 01		**Management of response to acts of unlawful interference**								
(01)		Describe the assistance each Contracting State shall provide to an aircraft subjected to an act of unlawful seizure. ***Source:* ICAO Annex 17, Chapter 5, 5.2 Response**	X	X	X	X	X			
(02)		State the circumstances which could prevent a Contracting State from detaining an aircraft on the ground after being subjected to an act of unlawful seizure. ***Source:* ICAO Annex 17, Chapter 5, 5.2 Response**	X	X	X	X	X			
010 12 06 00		**Operators' security programme**								
010 12 06 01		**Operators' security programme – Principles**								
(01)		Describe the principles of the written operator's security programme each Contracting State requires from operators. ***Source:* ICAO Annex 17, Chapter 3, 3.3 Aircraft operators**	X	X	X	X	X			
010 12 07 00		**Security procedures in other documents, i.e. ICAO Annexes 2, 6 and**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		14, ICAO Doc 4444, Regulation (EU) No 965/2012 and CS-ADR-DSN								
010 12 07 01		***ICAO Annex 2 — Rules of the Air, including Attachment B — Unlawful interference***								
(01)		Describe what the PIC should do, in a situation of unlawful interference, unless considerations aboard the aircraft dictate otherwise. ***Source:*** **ICAO Annex 2, Chapter 3, 3.7 Unlawful interference**	X	X	X	X	X			
(02)		Describe what the PIC, of an aircraft subjected to unlawful interference, 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. ***Source:*** **ICAO Annex 2, Attachment B 'Unlawful interference'**	X	X	X	X	X			
(03)		Describe what the PIC should attempt to do with regard to broadcast warnings and the level at which to proceed, in a situation of unlawful interference, if no applicable regional procedures for in-flight contingencies have been established. ***Source:*** **ICAO Annex 2, Attachment B 'Unlawful interference'**	X	X	X	X	X			
010 12 07 02		**ICAO Annex 6 – Operation of Aircraft Chapter 13 – Security**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the special considerations referring to flight crew compartment doors with regard to aviation security. ***Source:* ICAO Annex 6, Part I — International Commercial Air Transport — Aeroplanes, Chapter 13, 13.2 Security of the flight crew compartment**	X	X	X	X	X			
010 12 07 03		***ICAO Annex 14 Volume I — Aerodromes Chapter 3 — Physical characteristics***								
(01)		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. ***Source:* ICAO Annex 14 Volume I, Chapter 3, 3.14 Isolated aircraft parking position**	X	X	X	X	X			
010 12 07 04		**ICAO Doc 4444 – Air Traffic Management**								
(01)		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. ***Source:* ICAO Doc 4444, Chapter 15, 15.1.3 Unlawful interference and aircraft bomb threat**	X	X	X	X	X			
010 13 00 00		**AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION**								
010 13 01 00		**Essential definitions of ICAO Annex 13**								
010 13 01 01		**Definitions and descriptions**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Recall the definitions of the following terms: 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. ***Source:* ICAO Annex 13, Chapter 1 Definitions**	X	X	X	X	X			
(02)		Explain the difference between 'serious incident' and 'accident'. **Source: ICAO Annex 13, Chapter 1 Definitions and Attachment C 'List of examples of serious incidents'**	X	X	X	X	X			
(03)		Determine whether a certain occurrence has to be defined as a serious incident or as an accident. ***Source:* ICAO Annex 13, Chapter 1 Definitions and Attachment C 'List of examples of serious incidents'**	X	X	X	X	X			
(04)		Recognise the description of an accident or incident. ***Source:* ICAO Annex 13, Chapter 1 Definitions**	X	X	X	X	X			
010 13 02 00		**Accidents and incidents investigation in ICAO Annex 13**								
010 13 02 01		**Objectives and procedures**								
(01)		State the objective(s) of the investigation of an accident or incident according to ICAO Annex 13. ***Source:* ICAO Annex 13, Chapter 3, 3.1 Objective of the investigation**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the general procedures for the investigation of an accident or incident according to ICAO Annex 13. ***Source:*** **ICAO Annex 13, Chapter 4, 4.1;** **ICAO Annex 13, Chapter 5, 5.1 to 5.4.1**	X	X	X	X	X			
010 13 03 00		**Accidents and incidents investigation in EU regulations**								
010 13 03 01		**Occurrences**								
(01)		Identify an occurrence as being either an accident, incident or serious incident in Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation. ***Source:*** **Regulation (EU) No 996/2010, Article 2(1), (7) and (16) and Annex 'List of examples of serious incidents'**	X	X	X	X	X			
(02)		Describe the relationship between Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation. ***Source:*** **Regulation (EU) No 376/2014, p. L122/18 (3) and p. L122/21 (28);** **Regulation (EU) No 996/2010**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State the subject matter and scope of Regulation (EU) No 376/2014 (Article 3). ***Source:* Regulation (EU) No 376/2014, Article 3**	X	X	X	X	X			
(04)		Identify occurrences that must be reported (Regulation (EU) No 376/2014, Article 4). ***Source:* Regulation (EU) No 376/2014, Article 4**	X	X	X	X	X			
(05)		Identify occurrences that should be voluntarily reported (Regulation (EU) No 376/2014, Article 5). ***Source:* Regulation (EU) No 376/2014, Article 5**	X	X	X	X	X			
(06)		Describe how information from occurrences is collected, stored and analysed (Regulation (EU) No 376/2014, Articles 6, 8, 13 and 14). ***Source:* Regulation (EU) No 376/2014, Articles 6, 8, 13 and 14**	X	X	X	X	X			

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SUBJECT 021 – AIRCRAFT GENERAL KNOWLEDGE – AIRFRAME, SYSTEMS AND POWER PLANT

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
020 00 00 00		**AIRCRAFT GENERAL KNOWLEDGE**								
021 00 00 00		**AIRCRAFT GENERAL KNOWLEDGE – AIRFRAME, SYSTEMS AND POWER PLANT**								
021 01 00 00		**SYSTEM DESIGN, LOADS, STRESSES, MAINTENANCE**								
021 01 01 00		**System design**								
021 01 01 01		**Design concepts**								
(01)	X	Describe the following structural design philosophy: — safe life; — fail-safe (multiple load paths); — damage-tolerant.	X	X	X	X	X			
(02)		Explain the purpose of redundancy in aircraft design.	X	X	X	X	X			
021 01 01 02		**Level of certification**								
(01)	X	Explain why some systems are duplicated or triplicated	X	X	X	X	X			
(02)	X	Explain that all aircraft are certified according to specifications determined by the competent authority, and that these certification specifications cover aspects such as design, material quality and build quality.	X	X	X	X	X			
(03)	X	State that the certification specifications for aeroplanes issued by EASA are: — CS-23 for Normal, Utility, Aerobatic and Commuter Aeroplanes; — CS-25 for Large Aeroplanes.	X	X						
(04)	X	State that the certification specifications for rotorcraft issued by EASA are:			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— CS-27 for Small Rotorcraft; — CS-29 for Large Rotorcraft.								
021 01 02 00		**Loads and stresses**								
021 01 02 01		**Stress, strain and loads**								
(01)		Explain how stress and strain are always present in an aircraft structure both when parked and during manoeuvring. 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.	X	X	X	X	X			
(02)		Describe the following types of loads that an aircraft may be subjected to, when they occur, and how a pilot may affect their magnitude: — static loads; — dynamic loads; — cyclic loads.	X	X	X	X	X			
(03)		Describe the areas typically prone to stress that should be given particular attention during a pre-flight inspection, and highlight the limited visual cues of any deformation that may be evident.	X	X	X	X	X			
021 01 03 00		**Fatigue and corrosion**								
021 01 03 01		**Describe and explain fatigue and corrosion**								
(01)		Describe the effects of corrosion and how it can be visually identified by a pilot during the pre-flight inspection.	X	X	X	X	X			
(02)		Describe the operating environments where the risk of corrosion is increased and how to minimise the effects of the environmental factors.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain that aircraft have highly corrosive fluids on board as part of their systems and equipment.	X	X	X	X	X			
(04)		Explain fatigue, how it affects the useful life of an aircraft, and the effect of the following factors on the development of fatigue: — corrosion; — number of cycles; — type of flight manoeuvres; — stress level; — level and quality of maintenance.	X	X	X	X	X			
021 01 04 00		**Intentionally left blank**								
021 01 05 00		**Maintenance methods: hard-time and on-condition monitoring**								
(01)		Explain the following terms: — hard-time or fixed-time maintenance; — on-condition maintenance; — condition monitoring.	X	X	X	X	X			
021 02 00 00		**AIRFRAME**								
021 02 01 00		**Attachment methods**								
021 02 01 01		**Attachment methods and detecting the development of faulty attachments**								
(01)		Describe the following attachment methods used for aircraft parts and components: — riveting; — welding; — bolting; — pinning; — adhesives (bonding); — screwing.	X	X	X	X	X			
(02)		Explain how the development of a faulty attachment between aircraft parts or	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		components can be detected by a pilot during the pre-flight inspection.								
021 02 02 00		**Materials**								
021 02 02 01		**Composite and other materials**								
(01)	X	Explain the principle of a composite material, and give examples of typical non-metallic materials used on aircraft: — carbon; — glass; — Kevlar aramid; — resin or filler.	X	X	X	X	X			
(02)	X	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 and corrosion; — resistance to cost; — discovering damage during a pre-flight inspection.	X	X	X	X	X			
(03)		State that several types of materials are used on aircraft and that they are chosen based on type of structure or component and the required/desired material properties.	X	X	X	X	X			
021 02 03 00		**Aeroplane: wings, tail surface and control surfaces**								
021 02 03 01		**Design**								
(01)		Describe the following types of design and explain their advantages and disadvantages:	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— high-mounted wing; — low-mounted wing; — low- or mid-set tailplane; — T-tail.								
021 02 03 02		**Structural components**								
(01)		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)**								
(01)		Describe the vertical and horizontal loads on the ground and during normal flight.	X	X						
(02)		Describe the vertical and horizontal loads during asymmetric flight following an engine failure for a multi-engine aeroplane, and how a pilot may potentially overstress the structure during the failure scenario.	X	X						
(03)		Explain the principle of flutter and resonance for the wing and control surfaces.	X	X						
(04)		Explain the following countermeasures used to achieve stress relief and reduce resonance: — chord-wise and span-wise position of masses (e.g. engines, fuel, balance masses for wing and control balance masses); — torsional stiffness;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— bending flexibility; — fuel-balancing procedures during flight (automatic or applied by the pilot).								
021 02 04 00		**Fuselage, landing gear, doors, floor, windscreen and windows**								
021 02 04 01		**Construction, functions, loads**								
(01)	X	Describe the following types of fuselage construction: — monocoque, — semi-monocoque.	X	X	X	X	X			
(02)		Describe the construction and the function of the following structural components of a fuselage: — frames; — bulkhead; — pressure bulkhead; — stiffeners, stringers, longerons; — skin, doublers; — floor suspension (crossbeams); — floor panels; — firewall.	X	X	X	X	X			
(03)		Describe the loads on the fuselage due to pressurisation.	X	X						
(04)		Describe the following loads on a main landing gear: — touch-down loads (vertical and horizontal); — taxi loads on bogie gear (turns).	X	X						
(05)		Describe the structural danger of a nose-wheel landing with respect to: — fuselage loads; — nose-wheel strut loads.	X	X						
(06)		Describe the structural danger of a tail strike with respect to:	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— fuselage and aft bulkhead damage (pressurisation).								
(07)		Describe the door and hatch construction for pressurised and unpressurised aeroplanes including: — door and frame (plug type); — hinge location; — locking mechanism.	X	X						
(08)	X	Explain the advantages and disadvantages of the following fuselage cross sections: — circular; — double bubble; — oval; — rectangular.	X	X						
(09)		Explain why flight-deck windows are constructed with different layers.	X	X						
(10)		Explain the function of window heating for structural purposes.	X	X						
(11)		Explain the implication of a direct-vision window (see CS 25.773(b)(3)).	X	X						
(12)		Explain the need for an eye-reference position.	X	X						
(13)		Explain the function of floor venting (blow-out panels).	X	X						
(14)		Describe the construction and fitting of sliding doors.			X	X	X			
021 02 05 00		**Helicopter: structural aspects of flight controls**								
021 02 05 01		**Design and construction**								
(01)		List the functions of flight controls.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain why vertical and horizontal stabilizers may have different shapes and alignments.			X	X	X			
021 02 05 02		**Structural components and materials**								
(01)		Describe the fatigue life and methods of checking for serviceability of the components and materials of flight and control surfaces.			X	X	X			
021 02 05 03		**Loads, stresses and aeroelastic vibrations**								
(01)		Describe the dangers and stresses regarding safety and serviceability in flight when the manufacturer's design envelope is exceeded.			X	X	X			
(02)		Explain that blade tracking is important both to minimise vibration and to help ensure uniformity of flow through the disc.			X	X	X			
(03)		Describe the early indications and vibrations which are likely to be experienced when the main-rotor blades and tail rotor are out of balance or tracking, including the possible early indications due to possible fatigue and overload.			X	X	X			
(04)		Explain how a vibration harmonic can be set up in other components which can lead to their early failure.			X	X	X			
(05)		State the three planes of vibration measurement, i.e. vertical, lateral, fore and aft.			X	X	X			
021 02 06 00		**Structural limitations**								
021 02 06 01		**Maximum structural masses**								
(01)		Define and explain the following maximum structural masses: — maximum ramp mass;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— maximum take-off mass; — maximum zero fuel mass; — maximum landing mass. Remark: These limitations may also be found in the relevant part of Subject 031 ‘Mass and balance’, 032 ‘Performance (aeroplane)’ and 034 ‘Performance (helicopter)’.								
(02)		Explain that airframe life is limited by fatigue, created by alternating stress and the number of load cycles.	X	X						
(03)		Explain the maximum structural masses: — maximum take-off mass.			X	X	X			
(04)		Explain that airframe life is limited by fatigue, created by load cycles.								
021 03 00 00		**HYDRAULICS**								
021 03 01 00		**Hydromechanics: basic principles**								
021 03 01 01		**Concepts and basic principles**								
(01)	X	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		**Hydraulics systems**								
021 03 02 01		**Hydraulics fluids: types, characteristics, limitations**								
(01)	X	List and explain the desirable properties of a hydraulic fluid with regard to: — thermal stability; — corrosiveness; — flashpoint and flammability;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— volatility; — viscosity.								
(02)	X	State that hydraulic fluids are irritating to skin and eyes.	X	X	X	X	X			
(03)		List the two different types of hydraulic fluids: — synthetic; — mineral.	X	X	X	X	X			
(04)		State that different types of hydraulic fluids cannot be mixed.	X	X	X	X	X			
(05)	X	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**								
(01)		Explain the working principle of hydraulic system.	X	X	X	X	X			
(02)		Describe the difference in the principle of operation between a constant pressure system and a system pressurised only on specific demand.	X	X	X	X	X			
(03)		State the differences in the 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			
(04)	X	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			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		List the main uses of hydraulic systems.	X	X	X	X	X			
(06)		State that hydraulic systems can be classified as either high pressure (typically 3000 psi or higher) or low pressure (typically up to 2000 psi).	X	X	X	X	X			
(07)		State that a high-pressure hydraulic system is typically operating at 3000 psi but on some aircraft a hydraulic pressure of 4000 to 5000 psi may also be used.	X	X	X	X	X			
(08)		Explain the working principle of a low-pressure (0–2000 psi) system.	X	X	X	X	X			
(09)		Explain the advantages and disadvantages of a high-pressure system over a low-pressure system.	X	X	X	X	X			
(10)		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 revolutions per minute (rpm) (gear type).	X	X	X	X	X			
(11)		Explain the following different sources of hydraulic pressure, their typical application and potential operational limitations: manual; engine gearbox; electrical; air (pneumatic and ram-air turbine); hydraulic (power transfer unit) or reversible motor pumps; accessory.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(12)		Explain the following different sources of hydraulic pressure, their typical application and potential operational limitations: — manual; — engine; — gearbox; — electrical.			X	X	X			
(13)		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			
(14)		Explain the function of the demand pump installed on many transport aeroplanes.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(15)		Explain how redundancy is obtained by giving examples.	X	X	X	X	X			
(16)		Interpret a typical hydraulic system schematic to the level of detail as found in an aircraft flight crew operating manual (FCOM).	X	X	X	X	X			
(17)		Explain the implication of a high system demand.	X	X	X	X	X			
(18)		List and describe the instruments and alerts for monitoring a hydraulic system.	X	X	X	X	X			
(19)		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**								
(01)	X	Name, for an aeroplane, the following different landing-gear configurations: — nose wheel; — tail wheel.	X	X						
(02)	X	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 extensions systems								
(01)		Explain the function of the following components of a landing gear:	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— oleo leg/shock strut; — axles; — bogies and bogie beam; — drag struts; — side stays/struts; — torsion links; — locks (over centre); — gear doors.								
(02)		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.			X	X	X			
(03)		Name the different components of a landing gear, using the diagram appended to these LOs (021).	X	X	X	X	X			
(04)		Describe the sequence of events during normal operation of the landing gear.	X	X	X	X	X			
(05)		State how landing-gear position indication and alerting is implemented.	X	X	X	X	X			
(06)		Describe the various protection devices to avoid inadvertent gear retraction on the ground and explain the implications of taking off with one or more protection devices in place: — ground lock (pins); — protection devices in the gear retraction mechanism.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the speed limitations for gear operation (VLO (maximum landing gear operating speed) and VLE (maximum landing gear extended speed)).	X	X	X	X	X			
(08)		Describe the sequence for emergency gear extension: — unlocking; — operating; — down-locking.	X	X	X	X	X			
(09)		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**								
021 04 02 01		**Design, operation**								
(01)		Explain the operating principle of nose-wheel steering.	X	X	X	X	X			
(02)		Explain, for a helicopter, the functioning of differential braking with free-castoring nose wheel.			X	X	X			
(03)		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						
(04)		Explain the centring mechanism of the nose wheel.	X	X	X	X	X			
(05)		Define the term ‘shimmy’ and the possible consequences of shimmy for the nose- and the main-wheel system and explain the purpose of a shimmy damper to reduce the severity of shimmy.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain the purpose of main-wheel (body) steering.	X	X						
021 04 03 00		**Brakes**								
021 04 03 01		**Types and materials**								
(01)		Describe the basic operating principles of disc brakes.	X	X	X	X	X			
(02)		State the different materials used in a disc brake (steel, carbon).	X	X	X	X	X			
(03)		Describe the characteristics, advantages and disadvantages of steel and carbon brake discs with regard to: — weight; — temperature limits; — internal-friction coefficient; — wear.	X	X	X	X	X			
021 04 03 02		**System components, design, operations, indications and warnings**								
(01)		Explain the limitation of brake energy and describe the operational consequences.	X	X						
(02)		Explain how brakes are actuated: hydraulically, electrically.	X	X	X	X	X			
(03)		Explain the purpose of an in-flight wheel brake system.	X	X						
(04)		Describe the function of a brake accumulator.	X	X	X	X	X			
(05)		Describe the function of the parking brake.	X	X	X	X	X			
(06)		Explain the function of brake-wear indicators.	X	X						
(07)		Explain the reason for the brake-temperature indicator.	X	X						
021 04 03 03		**Anti-skid**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the operating principle of anti-skid where excessive brake pressure applied is automatically reduced for optimum breaking performance.	X	X						
(02)		Explain that the anti-skid computer compares wheel speed to aeroplane reference speed to provide the following: — 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						
(03)		Give examples of the impact of an anti-skid system on performance, and explain the implications of anti-skid system failure.	X	X						
021 04 03 04		**Autobrake**								
(01)		Describe the operating principle of an autobrake system.	X	X						
(02)		Explain why the anti-skid system must be available when using autobrakes.	X	X						
(03)		Explain the difference between the three modes of operation of an autobrake system: — OFF (system off or reset); — Armed (the system is ready to operate under certain conditions); — Activated/Deactivated (application of pressure on brakes).	X	X						
(04)		Describe how an autobrake system setting will either apply maximum braking (RTO or MAX) or result in a given rate of	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		deceleration, where the amount of braking applied may be affected by: — the use of reverse thrust; — slippery runway.								
021 04 04 00		**Wheels, rims and tyres**								
021 04 04 01		**Types, structural components and materials, operational limitations, thermal plugs**								
(01)	X	Describe the different types of tyres such as: — tubeless; — diagonal (cross ply); — radial (circumferential bias).	X	X	X	X	X			
(02)	X	Define the following terms: — ply rating; — tyre tread; — tyre creep; — retread (cover).	X	X	X	X	X			
(03)		Explain the function of thermal/fusible plugs.	X	X	X	X	X			
(04)		Explain the implications of and how to identify tread separation and wear or damage with associated increased risk of tyre burst.	X	X						
(05)		Explain why the ground speed of tyres is limited.	X	X						
(06)		Describe the following tyre checks a pilot will perform during the pre-flight inspection and identify probable causes: — cuts and damages; — flat spots.	X	X						
021 04 05 00		**Helicopter equipment**								
021 04 05 01		**Flotation devices**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain flotation devices, how they are operated, and their limitations.			X	X	X			
(02)		Explain why indicated airspeed (IAS) limitations before, during and after flotation-device deployment must be observed.			X	X	X			
021 05 00 00		**FLIGHT CONTROLS**								
021 05 01 00		**Aeroplane: primary flight controls**								
021 05 01 01		**Definition and control surfaces**								
(01)		Define a 'primary flight control'.	X	X						
(02)		List the following primary flight control surfaces: — elevator; — aileron, roll spoilers, flaperon; — rudder.	X	X						
(03)		List the various means of control surface actuation including: — manual; — fully powered (irreversible); — partially powered (reversible).	X	X						
021 05 01 02		**Manual controls**								
(01)		Explain the basic principle of a fully manual control system.	X	X						
021 05 01 03		**Fully powered controls (irreversible)**								
(01)		Explain the basic principle of a fully powered control system.	X	X						
(02)		Explain the concept of irreversibility in a flight control system.	X	X						
(03)		Explain the need for a 'feel system' in a fully powered control system.	X	X						
(04)		Explain the operating principle of a stabiliser trim system in a fully powered control system.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Explain the operating principle of rudder and aileron trim in a fully powered control system.	X	X						
021 05 01 04		**Partially powered controls (reversible)**								
(01)		Explain the basic principle of a partially powered control system.	X	X						
(02)		Explain why a 'feel system' is not necessary in a partially powered control system.	X	X						
021 05 01 05		**System components, design, operations, indications and warnings, degraded modes of operation, jamming**								
(01)		List and describe the function of the following components of a flight control system: — actuators; — control valves; — cables; — electrical wiring; — control surface position sensors.	X	X						
(02)		Explain how redundancy is obtained in primary flight control systems of large transport aeroplanes.	X	X						
(03)		Explain the danger of control jamming and the means of retaining sufficient control capability.	X	X						
(04)		Explain the methods of locking the controls on the ground and describe 'gust or control lock' warnings.	X	X						
(05)		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**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 05 02 01		**System components, design, operation, degraded modes of operation, indications and warnings**								
(01)		Define a 'secondary flight control'.	X	X						
(02)		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						
(03)		Describe secondary flight control actuation methods and sources of actuating power.	X	X						
(04)		Explain the function of a mechanical lock when using hydraulic motors driving a screw jack.	X	X						
(05)		Describe the requirement for limiting flight speeds for the various secondary flight control surfaces.	X	X						
(06)		For lift-augmentation devices, explain the load-limiting (relief) protection devices and the functioning of an auto-retraction system.	X	X						
(07)		Explain how a flap/slat asymmetry protection device functions, and describe the implications of a flap/slat asymmetry situation.	X	X						
(08)		Describe the function of an auto-slat system.	X	X						
(09)		Explain the concept of control surface blow-back (aerodynamic forces overruling hydraulic forces).	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 05 03 01		**Helicopter: flight controls**								
021 05 03 01		**Droop stops, control systems, trim systems, control stops**								
(01)		Explain the methods of locking the controls on the ground.			X	X	X			
(02)		Describe main-rotor droop stops and how rotor flapping is restricted.			X	X	X			
(03)		Explain the principle of phase lag and advance angle.			X	X	X			
(04)		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			
(05)		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			
(06)		Describe the operation of the spider control system.			X	X	X			
(07)		State the need for artificial feel in a hydraulically actuated flight control system.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Describe and explain the purpose of a trim system using the following terms: — 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			
(09)		Describe the different types of control runs.			X	X	X			
(10)		Explain the use of control stops.			X	X	X			
021 05 04 00		**Aeroplane: fly-by-wire (FBW) control systems**								
021 05 04 01		**Composition, explanation of operation, modes of operation**								
(01)		Explain that an FBW flight control system is composed of the following: — pilot's input command (control column/sidestick/rudder pedals); — electrical signalling paths, including: — pilot input to computer; — computer to flight control surfaces; — feedback from aircraft response to computer; — flight control computers; — actuators; — flight control surfaces.	X	X						
(02)		State the advantages of an FBW system in comparison with a conventional flight control system including: — weight; — pilot workload; — flight-envelope protection.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain why an FBW system is always irreversible.	X	X						
(04)		Explain the different modes of operation: — normal operation (e.g. normal law or normal mode); — downgraded operation (e.g. alternate law or secondary mode); — direct law.	X	X						
(05)		Describe the implications of mode degradation in relation to pilot workload and flight-envelope protection.	X	X						
(06)		Intentionally left blank								
(07)		For aircraft using sidestick for manual control, describe the implications of: — dual control input made by the pilot; — the control takeover facility available to the pilot.	X	X						
(08)		Intentionally left blank								
(09)		Explain why several types of computers are needed and why they should be dissimilar.	X	X						
(10)		Explain why several control surfaces on every axis are needed on FBW aircraft.	X	X						
(11)		Explain why several sensors are needed on critical parameters.	X	X						
021 05 05 00		**Helicopter: fly-by-wire (FBW) control systems**								
		To be introduced at a later date.								
021 06 00 00		**PNEUMATICS – PRESSURISATION AND AIR-CONDITIONING SYSTEMS**								
021 06 01 00		**Pneumatics/bleed-air supply**								
021 06 01 01		**Piston-engine air supply**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the following means of supplying air for the pneumatic systems for piston-engine aircraft: — compressor; — vacuum pump.	X	X	X	X	X			
(02)		State that an 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**								
(01)		State that the possible bleed-air sources for gas turbine engine aircraft are the following: — engine; — auxiliary power unit (APU); — ground supply.	X	X	X	X	X			
(02)		State that for an aeroplane a bleed-air supply can be used for the following systems or components: — ice protection; — engine air starter; — pressurisation of a hydraulic reservoir; — air-driven hydraulic pumps; — pressurisation and air conditioning.	X	X						
(03)		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			
(04)		State that the bleed-air supply system can comprise the following: — pneumatic ducts;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— isolation valve; — pressure-regulating valve; — engine bleed valve (HP/IP valves); — fan-air pre-cooler; — temperature and pressure sensors.								
(05)		Interpret a basic pneumatic system schematic to the level of detail as found in an FCOM.	X	X	X	X	X			
(06)		Describe the cockpit indications for bleed-air systems.	X	X	X	X	X			
(07)		Explain how the bleed-air supply system is controlled and monitored.	X	X	X	X	X			
(08)		State the following bleed-air malfunctions: — over-temperature; — over-pressure; — low pressure; — overheat/duct leak; And describe the potential consequences	X	X	X	X	X			
021 06 02 00		**Helicopter: air-conditioning systems**								
021 06 02 00		**Types, system components, design, operation, degraded modes of operation, indications and warnings**								
(01)		Describe the purpose of an air-conditioning system			X	X	X			
(02)		Explain how an air-conditioning system is controlled.			X	X	X			
(03)		Describe the vapour cycle air-conditioning system including system components, design, operation, degraded modes of operation and system malfunction indications.			X	X	X			
(04)		Identify the following components from a diagram of an air-conditioning system and			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		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.								
(05)		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**								
(01)		Explain that a pressurisation and an air-conditioning system of an aeroplane controls: — ventilation; — temperature; — pressure.	X	X						
(02)		Explain how humidity is controlled.	X	X						
(03)		Explain that the following components constitute a pressurisation system: — pneumatic system as the power source; — outflow valve; — outflow valve actuator; — pressure controller;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— excessive differential pressure-relief valve; — negative differential pressure-relief valve.								
(04)		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						
(05)		Describe the use of hot trim air.	X	X						
(06)		Define the following terms: — cabin altitude; — cabin vertical speed; — differential pressure; — ground pressurisation.	X	X						
(07)		Describe the operating principle of a pressurisation system.	X	X						
(08)		Describe the emergency operation by manual setting of the outflow valve position.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		Describe the working principle of an electronic cabin-pressure controller.	X	X						
(10)		State how the maximum operating altitude is determined.	X	X						
(11)		Explain: — why the maximum allowed value of cabin altitude is limited; — a typical value of maximum differential pressure for large transport aeroplanes; — the relation between cabin altitude, the maximum differential pressure and maximum aeroplane operating altitude.	X	X						
(12)		Explain the typical warning on a transport category aircraft when cabin altitude exceeds 10 000 ft.	X	X						
(13)		List and interpret typical indications of the pressurisation system.	X	X						
(14)		Describe the main operational differences between a bleed-air-driven air-conditioning system and an electrically driven air-conditioning system as found on aircraft without engine bleed-air system.	X	X						
021 07 00 00		**ANTI-ICING AND DE-ICING SYSTEMS**								
021 07 01 00		**Types, operation, indications**								
021 07 01 01		**Types, design, operation, indications and warnings, operational liminations**								
(01)		Explain the concepts of anti-icing and de-icing.	X	X	X	X	X			
(02)		Name the components of an aircraft which can be protected from ice accretion.	X	X	X	X	X			
(03)		State that on some aeroplanes the tail does not have an ice-protection system.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		State the different types of anti-icing/de-icing systems and describe their operating principle: — hot air; — electrical; — fluid.	X	X	X	X	X			
(05)		Describe the operating principle of the inflatable boot de-icing system.	X	X						
021 07 02 00		**Ice warnings systems**								
021 07 02 01		**Types, operation, and indications**								
(01)		Describe the different operating principles of the following ice detectors: — mechanical systems using air pressure; — electromechanical systems using resonance frequencies.	X	X						
(02)		Describe the principle of operation of ice warning systems.	X	X						
021 07 03 00		**Helicopter blade heating systems**								
021 07 03 01		**Limitations**								
(01)		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, characteristerics, limitations**								
(01)		State the types of fuel used by a piston engine and their associated limitations: — diesel; — JET-A1 (for high-compression engines); — AVGAS;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— MOGAS.								
(02)		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**								
(01)		state the tasks of the fuel system.	X	X	X	X	X			
(02)		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; — fuel-temperature sensor.	X	X	X	X	X			
(03)		Describe a gravity fuel feed system and a pressure feed fuel system.	X	X	X	X	X			
(04)		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			
(05)		Explain the function of cross-feed.	X	X	X	X	X			
(06)		Define the term ‘unusable fuel’.	X	X	X	X	X			
(07)		List the following parameters that are monitored for the fuel system: — fuel quantity (low-level warning);	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— fuel temperature.								
021 08 02 00		**Turbine engine**								
021 08 02 01		**Fuel: types, characteristics, limitations**								
(01)		State the types of fuel used by a gas turbine engine: — JET-A; — JET-A1; — JET-B.	X	X	X	X	X			
(02)		State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.	X	X	X	X	X			
(03)		State the existance of additives of freezing.	X	X	X	X	X			
021 08 02 02		**Design, operation, system components, indications**								
(01)		Explain the function of the fuel system: — lines; — centrifugal boost pump; — pressure valves; — fuel shut-off valve; — filter, strainer; — tanks (wing, tip, fuselage, tail); — bafflers/baffles; — sump; — vent system; — drain; — fuel-quantity sensor; — fuel-temperature sensor; — refuelling/defueling system; — fuel dump/jettison system.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Name the main components of the fuel system and state their location and their function: — trim fuel tanks; — bafflers; — refuelling/defueling system; — fuel dump/jettison system. Remark: For completion of list, please see 021 08 01 02 (02).	X	X	X	X	X			
(03)		Interpret a typical fuel system schematic to the level of detail as found in an aircraft FCOM.	X	X	X	X	X			
(04)		Explain the limitations in the event of loss of booster pump fuel pressure.	X	X	X	X	X			
(05)		Describe the use and purpose of drip sticks (manual magnetic indicators) (may also be known as dip stick or drop stick).	X	X						
(06)		Explain the considerations for fitting a fuel dump/jettison system and, if fitted, its function.	X	X	X	X	X			
021 09 00 00		**ELECTRICS**								
		Remark: For any reference to the direction of current flow, the convential current flow shall be sued, i.e. from positive to negative.								
021 09 01 00		**General, definitions, basic applications: circuit breakers, logic circuits**								
021 09 01 01		**Static electricity**								
(01)		Explain static electricity and describe the flying conditions where aircraft are most susceptible to build-up of static electricity.	X	X	X	X	X			
(02)		Describe a static discharger and explain the following:	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
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		— its purpose; — typical locations; — pilot's role of observing it during pre-flight inspection.								
(03)		Explain why an aircraft must first be grounded before refuelling/defueling.	X	X	X	X	X			
(04)		Explain the reason for electrical bonding	X	X	X	X	X			
021 09 01 02		Direct current (DC)								
(01)		Explain the term 'direct current' (DC), and state that current can only flow in a closed circuit.	X	X	X	X	X			
(02)	X	Explain the basic principles of conductivity and give examples of conductors, semiconductors and insulators.	X	X	X	X	X			
(03)		Describe the difference in use of the following mechanical switches and explain the difference in observing their state (e.g. ON/OFF), and why some switches are guarded: — toggle switch; — rocker switch; — pushbutton switch; — rotary switch. Explain the difference in observing their state (e.g. ON/OFF) and why some switches are guarded.	X	X	X	X	X			
(04)		Define voltage and current, and state their unit of measurement.	X	X	X	X	X			
(05)	X	Explain Ohm's law in qualitative terms.	X	X	X	X	X			
(06)	X	Explain the effect on total resistance when resistors are connected in series or in parallel.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)	X	State that resistances can have a positive or a negative temperature coefficient (PTC/NTC) and state their use.	X	X	X	X	X			
(08)		Define electrical power and state the unit of measurement.	X	X	X	X	X			
021 09 01 03		**Alternating current (AC)**								
(01)	X	Explain the term 'alternating current' (AC), and compare its use to DC with regard to complexity.	X	X	X	X	X			
(02)		Define the term 'phase', and explain the basic principle of single-phase and three-phase AC.	X	X	X	X	X			
(03)		State that aircraft can use single-phase or three-phase AC.	X	X	X	X	X			
(04)		Define frequency and state the unit of measurement.	X	X	X	X	X			
(05)	X	Define 'phase shift' in quantitative terms.	X	X	X	X	X			
021 09 01 04		**Intentionally left blank**								
021 09 01 05		**Intentionally left blank**								
021 09 01 06		**Electromagnetism**								
(01)		State that an electrical current produces a magnetic field.	X	X	X	X	X			
(02)		Describe how the strength of the magnetic field changes with the magnitude of the current.	X	X	X	X	X			
(03)		Explain the purpose and the working principle of a solenoid.	X	X	X	X	X			
(04)		Explain the purpose and the working principle of a relay.	X	X	X	X	X			
(05)		Explain the principle of electromagnetic induction and how two electrical components or systems may affect each other through this principle.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 09 01 07		**Circuit protection**								
(01)		Explain the working principle of a fuse and a circuit breaker.	X	X	X	X	X			
(02)		Explain how a fuse is rated.	X	X	X	X	X			
(03)		Describe the principal difference between the following types of circuit breakers: — thermal circuit breaker sensing magnitude of current; — magnetic circuit breaker sensing direction of current.	X	X	X	X	X			
(04)		Describe how circuit breakers may be used to reset aircraft systems/computers in the event of system failure (when part of a described procedure).	X	X	X	X	X			
(05)		Explain a short circuit in practical terms using Ohm's Law, power and energy expressions highlighting the risk of fire due to power transfer and extreme energy dissipation.	X	X	X	X	X			
(06)		Explain the risk of fire resulting from excessive heat in a circuit subjected to overheating.	X	X	X	X	X			
(07)		Explain the overcurrent situations may be transient.	X	X	X	X	X			
(08)		Explain the hazards of multiple resets of a circuir breaker or the use of incorrect fuse rating when replacing blown fuses.	X	X	X	X	X			
021 09 01 08		**Semiconductors and logic circuits**								
(01)		Describe the effect of temperature on semiconductors with regard to function and longevity of the component.	X	X	X	X	X			
(02)		Describe the following five basic logic functions, as used in aircraft FCOM documentation, and recognise their	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		schematic symbols according to the ANSI/MIL standard: — AND; — OR; — NOT; — NOR; — NAND.								
(03)		Interpret a typical logic circuit schematic to the level of details as found in an aircraft FCOM.	X	X	X	X	X			
021 09 02 00		**Batteries**								
021 09 02 01		**Types, characteristics and limitations**								
(01)		State the function of an aircraft battery.	X	X	X	X	X			
(02)		Name the types of rechargeable batteries used in aircraft: — lead-acid; — nickel-cadmium; — lithium-ion; — lithium-polymer.	X	X	X	X	X			
(03)		Compare the different battery types with respect to: — load behaviour; — charging characteristics; — risk of thermal runaway.	X	X	X	X	X			
(04)		Explain the term ‘cell voltage’ and describe how a battery may consist of several cells that combined provide the desirable voltage and capacity.	X	X	X	X	X			
(05)		Explain the difference between battery voltage and charging voltage.	X	X	X	X	X			
(06)		Define the term ‘capacity of batteries’ and state the unit of measurement used.	X	X	X	X	X			
(07)		State the effect of temperature on battery capacity and performance.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		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			
(09)		Explain how lithium-type batteries pose a threat to aircraft safety and what affects this risk: — numbers of batteries on board an aircraft including those brought on board by passengers; — temperature, of both battery and environment; — physical condition of the battery; — battery charging.	X	X	X	X	X			
(10)		Describe how to contain a battery thermal runaway highlighting the following: — how one cell can affect the neighbouring cells; — challenges if it happens in an aircraft during flight.	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 AC, rectified by integrated rectifying unit, the output is DC; — DC alternator: producing a DC output by using a rectifier; — AC generator: produces AC output; — starter generator: integrated combination of a generator and a starter motor; — permanent magnet alternator/ generator: self-exciting AC generator.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 09 03 01		**DC generation**								
(01)		Describe the basic working principle of a simple DC generator or DC alternator.	X	X	X	X	X			
(02)		Explain the principle of voltage control and why it is required.	X	X	X	X	X			
(03)		Explain the purpose of reverse current protection from the battery/busbar to the alternator.	X	X	X	X	X			
(04)		Describe the basic operating principle of astarter generator and state its purpose.	X	X	X	X	X			
021 09 03 02		**AC generation**								
(01)		Describe the working principle of a brushless three-phase AC generator.	X	X	X	X	X			
(02)		State that the generator field current is used to control voltage.	X	X	X	X	X			
(03)		State the relationship between output frequency and the rpm of a three-phase AC generator.	X	X	X	X	X			
(04)		Explain the term ‘frequency wild generator’.	X	X	X	X	X			
(05)		List the following different power sources that can be used for an aeroplane to drive an AC generator: — engine; — APU; — RAT; — hydraulic.	X	X						
(06)		List the following different power sources that can be used for a helicopter to drive an AC generator: — engine; — APU; — gearbox.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 09 03 03		**Constant speed drive (CSD) and integrated drive generator (IDG) systems**								
(01)		Describe the function of a CSD.	X	X						
(02)		Explain the parameters of a CSD that are monitored.	X	X						
(03)		Describe the function of a CSD.	X	X						
(04)		Explain the consequences of a mechanical disconnection during flight for a CSD and an IDG.	X	X						
(05)		Explain that a CSD/IDG has its own, independent oil system and how a leak from this may appear as an engine leak.	X	X						
021 09 03 04		**Transformers, transformer rectifier units (TRUs), static inverters**								
(01)		State the function of a transformer.	X	X	X	X	X			
(02)		State the function of a TRU and its purpose, including type of output.	X	X	X	X	X			
(03)		State the function of a static inverter and its purpose, including type of output.	X	X	X	X	X			
021 09 04 00		**Definitions**								
021 09 04 01		**General**								
(01)		Explain the function of a busbar.	X	X	X	X	X			
(02)		Describe the function of the following buses: — AC bus; — DC bus; — emergency AC or DC bus; — essential AC or DC bus; — battery bus; — hot bus, ground servicing or maintenance bus.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State 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			
(04)		Explain the function of external power.	X	X	X	X	X			
(05)		State that a priority sequence exists between the different sources of electrical power on ground and in flight.	X	X	X	X	X			
(06)		Explain the term 'load sharing'.	X	X	X	X	X			
(07)		Explain the term 'loading shedding'.	X	X	X	X	X			
(08)		Describe typical systems that can be shed in the event of supply failure, such as passenger entertainment system and galley power.	X	X	X	X	X			
(09)		Interpret a typical electrical system schematic to the level of detail as found in an aircraft FCOM.	X	X	X	X	X			
(10)		Explain the difference between a supply (e.g. generator) failure and a bus failure, and the operating consequences of either.	X	X	X	X	X			
021 09 04 02		**DC distribution**								
(01)		Describe a simple DC electrical system of a single-engine aircraft.	X	X	X	X	X			
(02)		Describe a DC electrical system of a multi-engine aircraft (CS-23/CS-27) including the distribution consequences of loss of DC supply or bus failure.	X	X	X	X	X			
(03)		Describe the DC part of an electrical system of a transport aircraft (CS-25/CS-27) including the distribution consequences of loss of DC supply or bus failure.	X	X	X	X	X			
(04)		Give examples of DC consumers.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 09 04 03		**AC distribution**								
(01)		Explain the difference in the principle of operation for a split AC electrical system.	X	X	X	X	X			
(02)		Describe the following distribution consequences: — power transfer between different power supplies; — power transfer in the event of a supply failure; — loss of all normal AC supplies.	X	X	X	X	X			
(03)		Give examples of AC consumers.	X	X	X	X	X			
(04)		Explain the conditions to be met for paralleling AC generators.	X	X	X	X	X			
(05)		State that volt-ampere (VA) is the unit for total power consumed in an AC system.	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**								
(01)		Give examples of system control, monitoring and annunciators using the following terms: — generator control unit (GCU) for monitoring generator output and providing network protection; — exciter contactor/breaker/relay for control of generator exciter field; — generator contactor/breaker/relay for connecting the generator to the network; — bus-tie contactor/breaker/relay for connecting busbars together; — generator switch on the flight deck for manual control of exciter contactor;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— IDG/CSD disconnect switch on the flight deck for mechanical disconnection of the generator; — bus-tie switch on the flight deck with AUTO and OFF positions only.								
(02)		Describe, for normal and degraded modes of operation, the following functions of an electrical load management system on ground and in flight using the terms in 021 09 04 04 (01): — distribution; — monitoring; — protection in the event of incorrect voltage; — protection in the event of incorrect frequency; — protection in the event of a differential fault.	X	X	X	X	X			
(03)		Describe the requirement for monitoring the aircraft batteries.	X	X	X	X	X			
(04)		Explain the importance of monitoring the temperature of nickel-cadmium and lithium-type batteries.	X	X	X	X	X			
(05)		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**								
(01)	X	State that the purpose of an electrical motor is to convert electrical energy into mechanical energy.	X	X	X	X	X			
(02)		State that because of the similarity in design, a generator and an electrical	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		motor may be combined into a starter generator.								
(03)		Explain that the size of the engine determines how much energy is required for starting, and state the following: — small turbine engines may be able to use the battery for a very limited number of start attempts; — large turbine engines require one or more power sources, either external or on-board.	X	X	X	X	X			
021 09 05 02		**Operating principle**								
(01)		Describe how the torque of an electrical motor is determined by the supplied voltage and current, and the resulting magnetic fields within the motor.	X	X	X	X	X			
(02)	X	State that electrical motors can be either AC or DC.	X	X	X	X	X			
(03)		Explain the consequences of the following: Rotor seizure; Rotor runway.	X	X	X	X	X			
021 09 05 03		**Components**								
(01)	X	Name the following components of an electrical motor: Rotor (rotating part of an electrical motor); Stator (stationary part of an electrical motor).	X	X	X	X	X			
021 10 00 00		**PISTON ENGINES**								
		Remark: This topic includes diesel and petrol engines.								
021 10 01 00		**General**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 10 01 01		**Types of internal-combustion engines: basic principles, definitions**								
(01)		Define the following terms and expressions: — rpm; — torque; — manifold absolute pressure (MAP); — power output; — specific fuel consumption; — compression ratio, clearance volume, swept (displaced) volume, total volume.	X	X	X	X	X			
021 10 01 02		**Engine: design, operation, components**								
(01)		Describe the basic operating principle of a piston engine: — 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			
(02)		Name and identify the various types of engine design with regard to cylinder arrangement and their advantages/disadvantages:	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— horizontally opposed; — in line; — radial; — and working cycle (four stroke: petrol and diesel).								
(03)		Describe the differences between petrol and diesel engines with respect to: — means of ignition; — maximum compression ratio; — regulating air or mixture supply to the cylinder; — pollution from the exhaust.	X	X	X	X	X			
021 10 02 00		**Fuel**								
021 10 02 01		**Types, grades, characteristics, limitations**								
(01)		Name the type of fuel used for petrol engines including its colour (AVGAS); — 100 (green); — 100LL (blue).	X	X	X	X	X			
(02)		Name the type of fuel normally used for aviation diesel engines (JET-A1).	X	X	X	X	X			
(03)	X	Define the term ‘octane rating’.	X	X	X	X	X			
(04)		Define the term ‘detonation’ and describe the causes and effects of detonation for both petrol and diesel engines.	X	X	X	X	X			
(05)		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			
(06)		Identify the conditions and power settings that promote detonation for petrol engines.	X	X	X	X	X			
(07)		Describe how detonation in petrol engines is recognised.	X	X	X	X	X			
(08)		Describe the method and occasions for checking the fuel for water content.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		State the typical value of fuel density for aviation gasoline and diesel fuel.	X	X	X	X	X			
(10)		Explain volatility, viscosity and vapour locking for petrol and diesel fuels.	X	X	X	X	X			
021 10 03 00		**Engine fuel pumps**								
021 10 03 01		**Engine-driven fuel pump**								
(01)		Explain the need for a separate engine-driven fuel pump.	X	X	X	X	X			
021 10 04 00		**Carburettor/injection system**								
021 10 04 01		**Caburettor: design, operation, degraded modes of operation, indications and warnings**								
(01)		State the purpose of a carburettor.	X	X	X	X	X			
(02)		Describe the operating principle of the simple float chamber carburettor.	X	X	X	X	X			
(03)		Describe the methods of obtaining mixture control over the whole operating engine power setting range (compensation jet, diffuser).	X	X	X	X	X			
(04)		Describe the methods of obtaining mixture control over the whole operating altitude range.	X	X	X	X	X			
(05)		Explain the purpose and the operating principle of an accelerator pump.	X	X	X	X	X			
(06)		Explain the purpose of power enrichment.	X	X	X	X	X			
(07)		Describe the function of the carburettor heat system.	X	X	X	X	X			
(08)		Explain the effect of carburettor heat on mixture ratio and power output.	X	X	X	X	X			
(09)		Explain the purpose and the operating principle of a primer pump.	X	X	X	X	X			
(10)		Discuss other methods for priming an engine (acceleration pumps).	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(11)		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**								
(01)		Explain the advantages and difference in operation of an injection system compared with a carburettor system.	X	X	X	X	X			
021 10 04 03		**Icing**								
(01)		Describe the causes and effects of carburettor icing and the action to be taken if carburettor icing is suspected.	X	X	X	X	X			
(02)		Name the meteorological conditions under which carburettor icing may occur.	X	X	X	X	X			
(03)		Describe the indications of the presence of carburettor icing for both a fixed pitch and a constant speed propeller.	X	X						
(04)		Describe the indications of the presence of carburettor icing for a helicopter.			X	X	X			
(05)		Describe the indications that will occur upon selection of carburettor heat depending on whether ice is present or not.	X	X	X	X	X			
(06)		Explain the reason for the use of alternate air on fuel injection systems and describe its operating principle.	X	X	X	X	X			
(07)		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**								
(01)		Specify the reasons for cooling a piston engine.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the design features to enhance cylinder air cooling for aeroplanes.	X	X						
(03)		Describe the design features to enhance cylinder air cooling for helicopters (e.g. engine-driven impeller and scroll assembly, baffles).			X	X	X			
(04)		Compare the differences between liquid- and air-cooling systems.	X	X	X	X	X			
(05)		Identify the cylinder head temperature indication to monitor engine cooling.	X	X	X	X	X			
(06)		Describe the function and the operation of cowl flaps.	X	X						
021 10 06 00		**Lubrication systems**								
021 10 06 01		**Lubricants: characteristics, limitations**								
(01)		Describe the term 'viscosity' including the effect of temperature.	X	X	X	X	X			
(02)		Describe the viscosity grade numbering system used in aviation.	X	X	X	X	X			
021 10 06 02		Design, operation, indications and warnings								
(01)		State the functions of a piston-engine lubrications	X	X	X	X	X			
(02)		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);	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— oil cooler; — oil cooler bypass valve (anti-surge and thermostatic); — pressure and temperature sensors; — lines.								
(03)		Describe a wet-sump lubrication system.	X	X	X	X	X			
(04)		State the differences between a wet – and a dry-sump lubrication system and their advantages and disadvantages.	X	X	X	X	X			
(05)		List the following factors that influence oil consumption: — oil grade; — cylinder and piston wear; — condition of piston rings.	X	X	X	X	X			
(06)		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**								
(01)		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			
(02)		State why piston engines are equipped with two electrically independent ignition systems.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State the function and operating principle of the following methods of spark augmentation: — starter vibrator (booster coil); — impulse-start coupling.	X	X						
(04)		State the function and operating principle of the following methods of spark augmentation: — starter vibrator (booster coil); — both magnetos live.			X	X	X			
(05)		Explain the function of the magneto check.	X	X	X	X	X			
(06)		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**								
(01)		Define the following terms: mixture; — chemically correct ratio (stoichiometric); — best power ratio; — lean (weak) mixture (lean or rich side of the exhaust gas temperature (EGT) top); — rich mixture.	X	X	X	X	X			
(02)		State the typical fuel-to-air ratio values or range of values for the above mixtures	X	X	X	X	X			
(03)		Describe the advantages and disadvantages of weak and rich mixtures.	X	X	X	X	X			
(04)		Describe the relation between engine-specific								
(05)		Describe the use of the exhaust gas temperature as an aid to mixture-setting	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain the relation between mixture ratio, cylinder head temperature, detonation and pre-ignition.	X	X	X	X	X			
(07)		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 Principles of flight (aeroplane)', 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**								
(01)		Describe the operating principle of a constant-speed propeller system under normal flight operations with the aid of a schematic.	X	X						
(02)		Explain the need for a MAP indicator to control the power setting with a constant-speed propeller.	X	X						
(03)		State the purpose of a torque-meter.	X	X						
(04)		State the purpose and describe the operation of a low-pitch stop (centrifugal latch).	X	X						
(05)		Describe the operating principle of a single-acting and a double-acting variable pitch propeller for a single- and multi-engine aeroplanes.	X	X						
(06)		Describe the function and the basic operating principle of synchronising and synchro-phasing systems.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the purpose and the basic operating principle of an auto-feathering system and unfeathering.	X	X						
021 10 09 03		**Reduction gearing: design**								
(01)		State the purpose of reduction gearing.	X	X						
021 10 09 04		**Propeller handling: associated control levers, degraded modes of operation, indications and warnings**								
(01)		Describe the checks to be carried out on a constant-speed propeller system after engine start.	X	X						
(02)		describe the operation of a constant-speed propeller syatem during flight at different true airspeed (TAS) and rpm including an overspeed propeller.	X	X						
(03)		Describe the operating principle of a variable pitch propeller when feathering and unfeathering, including the operation of cockpit controls.	X	X						
(04)		Describe the operating principle of a variable pitch propeller when reverse pitch is selected, including the operation of cockpit controls.	X	X						
(05)		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**								
(01)		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;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		- humidity.								
(05)		Explain the difference between an altitude-booster turbocharger and a ground-booster turbocharger.	X	X	X	X	X			
(06)		Explain turbo lag.	X	X	X	X	X			
(07)		Define the term 'critical altitude'.	X	X	X	X	X			
(08)		Explain the function of an intercooler.	X	X	X	X	X			
(09)		Define the terms 'full-throttle height' and 'rated altitude'.	X	X	X	X	X			
(10)		Explain the purpose of a supercharger and the basic differences from a turbocharger.	X	X	X	X	X			
021 10 10 02		**Engine handling**								
(01)		State the correct procedures for setting the engine controls when increasing or decreasing power.	X	X	X	X	X			
(02)		Define the following terms: - take-off power; - maximum continuous power.	X	X	X	X	X			
(03)		Describe the start problems associated with extreme cold weather.	X	X	X	X	X			
(04)		Describe the principal difference between a full-authority digital engine control (FADEC) system-controlled engine and traditional manual engine controls.	X	X	X	X	X			
(05)		Describe the engine controls available on the flight deck for a FADEC-controlled engine.	X	X	X	X	X			
(06)		Explain that the FADEC has full authority of the control of all engine parameters ensuring efficient and correct running of the engine, including protection in the event of failure.	X	X	X	X	X			

PRINTED OA

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the need for FADEC redundancy with regard to power supply and data input and output.	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**								
(01)		Describe how thrust is produced by a basic gas turbine engine.	X	X						
(02)		Describe the simple form of the thrust formula for a basic, straight jet engine and perofrm simple calculations (including pressure thrust).	X	X						
(03)		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 and components of turbine engines**								
(01)		List the main components of a basic gas turbine engine: - inlet; - compressor; - combustion chamber; - turbine; - outlet.	X	X	X	X	X			
(02)		Describe the variation of static pressure, temperature and axial velocity in agas turbine engine under normal operating conditions and with the aid of a working cycle diagram.	X	X	X	X	X			
(03)		Describe the differences between absolute, circumferential (tangential) and axial velocity.	X	X	X	X	X			

BRUNEI DCA

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		List the different types of gas turbine engines: - straight jet; - turbofan; - turboprop.	X	X						
(05)		State that a gas turbine engine can have one or more spools.	X	X	X	X	X			
(06)		Describe how thrust is produced by turbojet and turbofan engines.	X	X						
(07)		Describe how power is produced by turboprop engines.	X	X						
(08)		Describe the term 'equivalent horsepower' (= thrust horsepower + shaft horsepower).	X	X						
(09)		Explain the principle of a free turbine or free-power turbine.	X	X	X	X	X			
(10)		Define the term 'bypass ratio' and perform simple calculations to determine it.	X	X						
(11)		Define the terms 'propulsive power', 'propulsive efficiency', 'thermal efficiency' and 'total efficiency'.	X	X						
(12)		Describe the influence of compressor-pressure ratio on thermal efficiency.	X	X	X	X	X			
(13)		Explain the variations of propulsive efficiency with forward speed for turbojet, turbofan and turboprop engines.	X	X						
(14)		Define the term 'specific fuel consumption' for turbojets and turboprops.	X	X						
021 11 01 03		**Coupled turbine engine: design, operation, components and materials**								
(01)		Name the main assembly parts of a coupled turbine engine and explain its operation.			X	X	X			
(02)		Explain the limitations of the materials used with regard to maximum turbine			X	X	X			

EASA UNEDITED DCA

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		temperature, engine and drive train torque limits.								
(03)		Describe the possible effects on engine components when limits are exceeded.			X	X	X			
(04)		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**								
(01)		Describe the design methods to keep the engine's size small for installation in helicopters.			X	X	X			
(02)		List the main components of a free-turbine engine.			X	X	X			
(03)		Describe how the power is developed by a turboshaft/free-turbine engine.			X	X	X			
(04)		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**								
(01)		State the functions of the engine air inlet/air intake.	X	X						
(02)		Describe the geometry of a subsonic (pitot-type) air inlet.	X	X						
(03)		Explain the gas-parameter changes in a subsonic air inlet at different flight speeds.	X	X						
(04)		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						

PRUNED DCA

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 11 02 02		**Compressor and diffuser**								
(01)		State the purpose of the compressor.	X	X	X	X	X			
(02)		Describe the working principle of a centrifugal and an axial flow compressor.	X	X	X	X	X			
(03)		Name the following main components of a single stage and describe their function for a centrifugal compressor: - impeller; - diffuser.	X	X	X	X	X			
(04)		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			
(05)		Describe the gas-parameter changes in a compressor stage.	X	X	X	X	X			
(06)		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			
(07)		State the advantages and disadvcantages of increasing the number of stages in an centrifugal compressor.	X	X	X	X	X			
(08)		Explain the difference in sensitivity for FOD of a centrifugal compressor compared with an axial flow type.	X	X	X	X	X			
(09)		Explain the convergent air annulus through an axial flow compressor.	X	X	X	X	X			
(10)		Describe the reason for twisting the compressor blades.	X	X	X	X	X			
(11)		State the tasks of inlet guide vanes (IGVs).	X	X	X	X	X			
(12)		State the reason for the clicking noise whilst the compressor slowly rotates on the ground.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(13)		State the advantages of increasing the number of spools.	X	X	X	X	X			
(14)		Explain the implications of tip losses and describe the design features to minimise the problem.	X	X	X	X	X			
(15)		Explain the problems of blade bending and flapping and describe the design features to minimise the problem.	X	X	X	X	X			
(16)		Explain the following terms: - compressor stall; - engine surge.	X	X	X	X	X			
(17)		State the conditions that are possible causes of stall and surge.	X	X	X	X	X			
(18)		Describe the indications of stall and surge.	X	X	X	X	X			
(19)		Describe the design features used to minimise the occurance of stall and surge.	X	X	X	X	X			
(20)		Describe a compressor map (surge envelope) with rpm limits, stall limit, steady state line and acceleration line.	X	X	X	X	X			
(21)		Describe the function of the diffuser.	X	X	X	X	X			
021 11 02 03		**Combustion chamber**								
(01)		Define the purpose of the combustion chamber.	X	X	X	X	X			
(02)		List the requirements for combustion.	X	X	X	X	X			
(03)		Describe the working principle of a combustion chamber.	X	X	X	X	X			
(04)		Explain the reason for reducing the airflow axial velocity at the combustion chamber inlet (snout).	X	X	X	X	X			
(05)		State the function of the swirl vanes (swirler).	X	X	X	X	X			
(06)		State the function of the drain valves.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Define the terms ‘primary airflow’ and ‘secondary airflow’, and explain their purpose.	X	X	X	X	X			
(08)		Explain the following two mixture ratios: - primary airflow to fuel: - total airflow (within the combustion chamber) to fuel.	X	X	X	X	X			
(09)		Describe the gas-parameter changes in the combustion chamber.	X	X	X	X	X			
(10)		State the typical maximum value of the outlet temperature of the combustion chamber.	X	X	X	X	X			
(11)		Describe the following types of combustion chambers and state the differences between them: - can type; - can-annular, cannular or auto-annular; - annular; - reverse-flow annular.	X	X	X	X	X			
021 11 02 04		**Turbine**								
(01)		Explain the purpose of a turbine in different types of gas turbine engines.	X	X	X	X	X			
(02)		Describe the principles of operation of impulse, reaction and impulse-reaction axial flow turbines.	X	X	X	X	X			
(03)		Name the main components of a turbine stage and their function.	X	X	X	X	X			
(04)		Describe the working principle of turbine stage and their function.	X	X	X	X	X			
(05)		Describe the gas-parameter changes in a turbine stage.	X	X	X	X	X			
(06)		Describe the function and working principle of active clearance control.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Describe the implications of tip losses and the means to minimise them.	X	X	X	X	X			
(08)		Explain why the available thrust is limited by the turbine inlet temperature.	X	X						
(09)		Explain the divergent gas-flow annulus through an axial-flow turbine.	X	X	X	X	X			
(10)		Explain the high mechanical thermal stress in the turbine blades and wheels/discs.	X	X	X	X	X			
021 11 02 05		**Aeroplane: exhaust**								
(01)		Name the following main components of the exhaust unit and their function: - jet pipe; - propelling nozzle; - exhaut cone.	X	X						
(02)		Describe the working principle of the exhaust unit.	X	X						
(03)		Describe the gas-parameter changes in the exhaust unit.	X	X						
(04)		Define the term ‘choked exhaust nozzle’ (not applicable to turboprops).	X							
(05)		Explain how jet exhaust noise van be reduced.	X	X						
021 11 02 06		**Helicopter: air intake**								
(01)		Name and explain the main task of the engine air intake.			X	X	X			
(02)		Describe the use of a convergent air-intake ducting on helicopters.			X	X	X			
(03)		Describe the reasons for and the dangers of the following operational problems concerning engine air intake: - airflow separations; - intake icing; - intake damage;			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		- FOD; - heavy in -flight turbulence.								
(04)		Describe the conditions and circumstances during ground operations when FOD is most likely to occur.			X	X	X			
(05)		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			
(06)		Describe the function of the heated pads on some helicopter air intakes.			X	X	X			
021 11 02 07		**Helicopter: exhaust**								
(01)		Describe the working principle of the exhaust unit.			X	X	X			
(02)		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**								
(01)		Name the main components of the engine fuel system and state their function: - filters; - low-pressure (LP) pump; - high-pressure (HP) pump; - fuel manifold; - fuel nozzles; - HP fuel cock; - fel control; or - hydromechanical unit.	X	X	X	X	X			
(02)		Name the two types of engine-driven high-pressure pumps, such as: - gear-type; - swash plate-type.	X	X	X	X	X			
(03)		State the tasks of the fuel control unit.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		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**								
(01)		State the tasks of the engine control system.	X	X	X	X	X			
(02)		List the following different types of engine control systems: - hydromechanical; - hydromechanical with a limited authority electronic supervisor; - single-channel FADEC with hydromechanical backup; - dual-channel FADEC with no backup or any other combination.	X	X	X	X	X			
(03)		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 thrust lever angle (TLA) (see also AMC to CS-E-50), and an EGT protection function and engine overspeed.	X		X	X				
(04)		Explain how redundancy is achieved by using more than one channel in a FADEC system.	X		X	X				
(05)		State the consequences of a FADEC single input data failure.	X		X	X				
(06)		State that all input and output data is checked by both channels in a FADEC system.	X		X	X				
(07)		State that a FADEC system uses its own sensors and that, in some cases, also data from aircraft systems is used.	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		State that a FADEC must have its own source of electrical power.	X		X	X				
021 11 03 03		**Engine lubrication**								
(01)		State the tasks of an engine lubrication system.	X	X						
(02)		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						
(03)		Explain that each spool is fitted with at least one ball bearing and two or more roller bearings.	X	X						
(04)		Explain the use of compressor air in oil-sealing systems (e.g. labyrinth seals).	X	X						
021 11 03 04		**Engine auxiliary gearbox**								
(01)		State the tasks of the auxiliary gearbox.	X	X						
(02)		Describe how the gearbox is driven and lubricated.	X	X						
021 11 03 05		**Engine ignition**								
(01)		State the task of the ignition system.	X	X						
(02)		Name the following main components of the ignition system and state their function: — power sources; — igniters.	X	X						
(03)		State why jet turbine engines are equipped with two electrically independent ignition systems.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain the different modes of operation of the ignition system.	X	X						
021 11 03 06		**Engine starter**								
(01)		Name the main components of the starting system and state their function.	X	X						
(02)		Explain the principle of a turbine engine start.	X	X						
(03)		Describe the following two types of starters: — electric; — pneumatic.	X	X						
(04)		Describe a typical start sequence (on ground/inflight) for a turbofan.	X	X						
(05)		Define ‘self-sustaining rpm’.	X	X						
021 11 03 07		**Reverse thrust**								
(01)		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						
(02)		Explain the principle of a reverse-thrust system.	X	X						
(03)		Identify the advantages and disadvantages of using reverse thrust.	X	X						
(04)		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;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		cascade vanes.								
(05)		Explain the implications of reversing the cold stream (fan reverser) only on ahigh bypass ratio engine.	X	X						
(06)		Describe the protection features against inadvertent thrust-reverse deployment in flight as present on most transport aeroplanes.	X	X						
(07)		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**								
(01)		State the task of the lubrication system.			X	X	X			
(02)		List and describe the common helicopter lubrication systems.			X	X	X			
(03)		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			
(04)		Identify and name the components of a helicopter lubrication system from a diagram.			X	X	X			
(05)		Identify the identifications used to monitor a lubrication system including warning systems.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain the differences and appropriate use of straight oil and compound oil, and describe the oil numbering system for aviation use.			X	X	X			
(07)		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			
(08)		Explain and describe the starter motor and the sequence of events when starting, and that for most helicoptes the starter becomes the generator after the starting sequence is over.			X	X	X			
(09)		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**								
(01)		Explain the following aeroplane engine ratings: - take-off; - go-around; - maximum continuous thrust/power; - maximum climb thrust/power.	X	X						
(02)		Explain spool-up time.	X	X	X	X	X			
(03)		Explain the reason for the difference between ground and approach flight idle values (rpm).	X	X						
(04)		State the parameters that can be used for setting and monitoring the thrust/power.	X	X	X	X	X			
(05)		Describe the terms ‘alpha range’, beta range’ and ‘reverse thrust’ as applied to a turboprop power lever.	X	X						
(06)		Explain the dangers of inadvertent beta-range selection in flight for a turboprop.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the purpose of engine trending.	X	X						
(08)		Explain how the exhaust gas temperature is used to monitor turbine stress.	X	X	X	X	X			
(09)		Describe the effect of engine acceleration and deceleration on the EGT.	X	X	X	X				
(10)		Describe the possible effects on engine components when EGT limits are exceeded.	X	X	X	X	X			
(11)		Explain why engine-limit exceedances must be reported.	X	X	X	X	X			
(12)		Explain the limitations on the use of the thrust-reverser system at low forward speed.	X	X			X			
(13)		Explain the term ‘engine seizure’.	X	X	X	X	X			
(14)		State the possible causes of engine seizure and explain their preventative measures.	X	X	X	X	X			
(15)		Describe the potential consequences of a leak in the following two designs of fuel and oil heat exchanger: — oil pressure higher than fuel pressure with oil leaking into the fuel system, potentially affecting the combustion and running of the engine; — fuel pressure higher than oil pressure with fuel leaking into the oil system, potentially increasing the risk of a fire due to fuel entering warm parts of the engine that should be free from fuel.	X	X	X	X	X			
(16)		Explain oi-filter clogging (blockage) and the implications for the lubrication system.	X	X	X	X	X			
(17)		Give examples of monitoring instruments of an engine.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(18)		Describe how to identify and assess engine damage based on instrument indications.	X	X	X	X	X			
021 11 04 02		**Starting malfunctions**								
(01)		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						
(02)		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; — no FADEC indications.	X	X						
021 11 04 03		**Relight envelope**								
(01)		Explain the relight envelope.	X	X						
021 11 05 00		**Performance aspects**								
021 11 05 01		**Thrust, performance aspects, and limitations**								
(01)		Describe the variation of thrust and specific fuel consumption with altitude at constant TAS.	X	X						
(02)		Describe the variation of thrust and specific fuel consumption with TAS at constant altitude.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the term 'flat-rated engine' by describing the change of take-off thrust, turbine inlet temperature and engine rpm with outside air temperature (OAT).	X	X						
(04)		Define the term 'engine pressure ratio' (EPR).	X	X						
(05)		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						
(06)		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 and limitations***	X	X						
(01)		Describe engine rating torque limits for take-off, transient and maximum continuous.			X	X	X			
(02)		Describe turbine outlet temperature (TOT) limits for take-off.			X	X	X			
(03)		Explain why TOT is limiting factor for helicopter performance.			X	X	X			
(04)		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			
(05)		Explain that hovering downwind, on some helicopters, will noticeably increase the engine TOT.			X	X	X			
(06)		Explain the reason why the engine performance is less when aircraft			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		accessories (i.e. anti-ice, heating, hoist, filters) are switched on.								
(07)		Describe the effects of use of bleed air on engine parameters.			X	X	X			
(08)		Explain that, on some helicopters, exceeding the TOT limit may cause the main rotor to droop (slow down).			X	X	X			
(09)		Describe overtorquing and explain the consequences.			X	X	X			
021 11 06 00		**Auxiliary power unit (APU)**								
021 11 06 01		**Design, operation, functions, operational limitations**								
(01)		State that an APU is agas turbine engine and list its tasks.	X		X	X				
(02)		State the difference between the two types of APU inlets.	X		X	X				
(03)		Define ‘maximum operating and maximum stating altitude’.	X		X	X				
(04)		Name the typical APU control and monitoring instruments.	X		X	X				
(05)		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**								
(01)		Explain the operating principle of the following types of smoke detection sensors: — optical; — ionising.	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Give an example of warnings, indications and function tests.	X	X	X	X	X			
021 12 02 00		**Fire-protection systems**								
021 12 02 01		**Fire extinguishing (engine and cargo compartments)**								
(01)		Explain the operating principle of a built-in fire-extinguishing system and describe its components.	X	X	X	X	X			
(02)		State that two discharges must be provided for each engine (see CS 25.1195(c) Fire-extinguisher systems).	X	X						
021 12 02 02		**Fire detection**								
(01)		Explain the following principles of fire detection: resistance and capacitance; gas pressure.	X	X	X	X	X			
(02)		Explain fire-detection applications such as: bimetallic; continuous loop; gaseous loop (gas-filled detectors).	X	X	X	X	X			
(03)		Explain why generally double-loop systems are used.	X	X	X	X	X			
(04)		Give an example of warnings, indications and function tests of a fire-protection system.	X	X	X	X	X			
021 12 03 01		**Rain-protection system**								
021 12 03 01		**Principle and method of operation**								
(01)		Explain the principle and method of operation of the following windshield rain-protection systems for an aeroplane: — wipers; — liquids (rain-repellent);	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— coating.								
(02)		Explain the principle and method of operation of wipers for a helicopter.			X	X	X			
021 13 00 00		**OXYGEN SYSTEMS**								
021 13 01 00		**Cockpit, portable and chemical oxygen systems**								
021 13 01 01		**Operating principles, actuation methods, comparison**								
(01)		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						
(02)		Describe the operating principle and the purposes of the following two portable oxygen systems: — smoke hood; — portable bottle.	X	X						
(03)		Describe the following two oxygen systems that can be used to supply oxygen to passengers: — fixed system (chemical oxygen generator or gaseous system); — portable.	X	X						
(04)		Describe the actuation methods (automatic and manual) and the functioning of a passenger oxygen mask.	X	X						
(05)		Compare chemical oxygen generators to gaseous systems with respect to: — capacity; — flow regulation.	X	X						
(06)		Sate the dangers of grease or oil related to the use of oxygen systems.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 14 00 00		**HELICOPTER: MISCELLANEOUS SYSTEMS**								
021 14 01 00		**Variable rotor speed, active vibration suppression, night-vision goggles (NVG)**								
021 14 01 01		**Variable rotor speed**								
(01)		Explain the system for 'beeping' the NR to its upper limit.			X	X	X			
021 14 01 02		**Active vibration suppression**								
(01)		Explain and describe how the active vibration suppression system works through high-speed actuators and accelerometer inputs.			X	X	X			
021 14 01 03		**NVG**								
		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**								
(01)		Describe the following rotor-head systems: — teetering (semi-articulated); — articulated; — hingeless (rigid); — bearingless (semi-articulated).			X	X	X			
(02)		Describe in basic terms the following configuration of rotor systems and their advantages and disadvantages: — tandem; — coaxial; — side by side.			X	X	X			
(03)		Explain how flapping, dragging and feathering is achieved in each rotor-head system.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 15 01 02		**Structural components and materials, stresses, structural limitations**								
(01)		Identify from a diagram the main structural components of the main types of rotor-head systems.			X	X	X			
(02)		List and describe the methods used to detect damage and cracks.			X	X	X			
(03)		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			
(04)		Describe the various rotor-head lubrication methods.			X	X	X			
021 15 01 03		**Design and construction**								
(01)		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**								
(01)		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**								
(01)		Describe the following tail-rotor systems: - delta-3 hinge effect; - multi-blended delta-3 effect; - Fenestron or ducted fan tail rotor;			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		- no tail rotor (NOTAR) low-velocity air jet flows from tangential slots (the Coandă effect); - NOTAR high-velocity air jet flows from adjustable nozzles (the Coandă effect).								
(02)		Identify from a diagram the main structural components of the four main types of tail-rotor systems.			X	X	X			
(03)		Explain and describe the methods to detect damage and cracks on the tail rotor and assembly.			X	X	X			
(04)		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			
(05)		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			
(06)		Explain pitch-input mechanisms.			X	X	X			
(07)		Explain the relationship between tail-rotor thrust and engine power.			X	X	X			
(08)		Describe how the vertical fin on some types reduces the power demand of the tail rotor.			X	X	X			
021 15 02 02		Design and construction								
(01)		List and describe the various tail-rotor designs and construction methods used on the helicopters currently in service.			X	X	X			
021 16 00 00		**HELICOPTER: TRANSMISSION**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
021 16 01 00		**Main gearbox**								
021 16 01 01		**Different types, design, operation, limitations**								
(01)		Descrie 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			
(02)		Describe the reason for limitations on multi-engine helicopter transmissions in various engine-out situations.			X	X	X			
(03)		Describe how the passive vibration control works with gearbox mountings.			X	X	X			
021 16 02 00		**Rotor brake**								
021 16 02 01		**Types, operational considerations**								
(01)		Describe the main function of the disc type of rotor brake.			X	X	X			
(02)		Describe both hydraulic- and cable-operated rotor-brake systems.			X	X	X			
(03)		Describe the different options for the location of the rotor brake.			X	X	X			
(04)		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;			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— cockpit annunciation of rotor-brake operation.								
021 16 03 00		**Auxiliary systems**								
021 16 03 01		**Powering the air-conditioning system**								
(01)		Explain how for the air-conditioning system is taken from the auxiliary gearbox.			X	X	X			
021 16 04 00		**Driveshaft and associated installation**								
021 16 04 01		**Power, construction, materials, speed and torque**								
(01)		Describe how power is transmitted from the engine to the main-rotor gearbox.			X	X	X			
(02)		Describe the material and construction of the driveshaft.			X	X	X			
(03)		Explain the need for alignment between the engine and the main-rotor gearbox.			X	X	X			
(04)		Identify how temporary misalignment occurs between driving and driven components.			X	X	X			
(05)		Explain the relantionship between driveshaft speed and torque.			X	X	X			
(06)		Describe the methods with which power is delivered to the tail rotor.			X	X	X			
(07)		Describe and identify the construction and materials of tail-rotor/Fenestron driveshafts.			X	X	X			
021 16 05 00		**Intermediate and tail gearbox**								
021 16 05 01		**Lubrication, gearing**								
(01)		Explain and describe the various arrangements when the drive changes direction and the need for an intermediate or tail gearbox.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the lubrication requirements for intermediate and tail-rotor gearboxes and methods of checking levels.			X	X	X			
(03)		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**								
021 16 06 01		**Purpose, operation, components, serviceability**								
(01)		Explain the purpose of a clutch.			X	X	X			
(02)		Describe and explain the operation of a: — centrifugal clutch; — actuated clutch.			X	X	X			
(03)		List the typical components of the various clutches.			X	X	X			
(04)		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**								
021 16 07 01		**Purpose, operation, components, location**								
(01)		Explain the purpose of a freewheel.			X	X	X			
(02)		Describe and explain the operation of a: — cam- and roller-type freewheel; — sprag-clutch-type freewheel.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		List the typical components of the various freewheels.			X	X	X			
(04)		Identify the various locations of freewheels in power plant and transmission systems.			X	X	X			
(05)		Explain the implications regarding the engagement and disengagement of the freewheel.			X	X	X			
021 17 00 00		**HELICOPTERS: BLADES**								
021 17 01 00		**Main-rotor design and blade design**								
021 17 01 01		**Design, construction**								
(01)		Describe the different types of blade construction and the need for torsional stiffness.			X	X	X			
(02)		Describe the principles of heating systems/pads on some blades for anti-icing/de-icing.			X	X	X			
(03)		Describe the fully articulated rotor with hinges and feathering hinges.			X	X	X			
021 17 01 02		**Structural components and materials**								
(01)		List the materials used in the construction of main-rotor blades.			X	X	X			
(02)		List the main structural components of a main-rotor blade and their function.			X	X	X			
(03)		Describe the drag hinge of the fully articulated rotor and the lag flexure in the hingeless rotor.			X	X	X			
(04)		Explain the necessity for drag dampers.			X	X	X			
021 17 01 03		**Forces and stresses**								
(01)		Describe main-rotor blade-loading on the ground and in-flight.			X	X	X			
(02)		Describe where the most common stress areas are on rotor blades.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Show how the centrifugal forces depend on rotor rpm and blade mass and how they pull on the blade's attachment to the hub. Justify the upper limit of the rotor rpm.			X	X	X			
(04)		Assume a rigid attachment and show how thrust may cause huge oscillating bending moments which stress the attachment.			X	X	X			
(05)		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			
(06)		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			
021 17 01 04		**Structural limitations**								
(01)		Explain the structural limitations in terms of bending and rotor rpm.			X	X	X			
021 17 01 05		**Adjustment**								
(01)	X	Explain the use of trim tabs.			X	X	X			
021 17 01 06		**Tip shape**								
(01)		Describe the various blade-tip shapes used by different manufacturers and compare their advantages and disadvantages.			X	X	X			
021 17 01 07		**Origins of the vertical vibrations**								
(01)		Explain the lift (thrust) variations per revolution of a blade and the resulting vertical total rotor thrust (TRT) variation in the case of perfectly identical blades.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Show the resulting frequencies and amplitudes as a function of the number of blades.			X	X	X			
(03)		Explain the thrust variation in the case of an out-of-track blade, causes, and frequencies (one-per-revolution).			X	X	X			
021 17 01 08		**Lateral vibrations**								
(01)		Explain blade imbalances, causes, and effects.			X	X	X			
021 17 02 00		**Tail-rotor design and blade design**								
021 17 02 01		**Design, construction**								
(01)		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			
(02)		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			
(03)		Describe how, for some helicopters, anti-icing/de-icing systems are designed into the blade construction.			X	X	X			
(04)		Describe the two-bladed rotor with a teetering hinge, and rotors with more than two blades.			X	X	X			
(05)		Describe the dangers to ground personnel and to the rotor blades, and how to minimise these dangers.			X	X	X			
021 17 02 02		**Intentionally left blank**								
021 17 02 03		**Stresses, vibrations and balancing**								
(01)		Describe the tail-rotor blade-loading on the ground and in flight.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the sources of vibration of the tail rotor and the resulting high frequencies.			X	X	X			
(03)		Explain balancing and tracking of the rotor.			X	X	X			
021 17 02 04		**Structural limitations**								
(01)		Describe the structural limitations of the tail-rotor blades.			X	X	X			
(02)		Describe the method of checking the strike indicators placed on the tip of some tail-rotors blades.			X	X	X			
021 17 02 05		**Adjustment**								
(01)		Describe the adjustment of yaw pedals in the cockpit to obtain full-control authority of the tail rotor.			X	X	X			
021 17 02 06		**The Fenestron**								
(01)		Describe the technical layout of a Fenestron tail rotor.			X	X	X			
(02)		Explain the advantages and disadvantages of a Fenestron tail rotor.			X	X	X			
021 17 02 07		**No tail rotor (NOTAR)**								
(01)		Describe the technical layout of a NOTAR design.			X	X	X			
(02)		Explain the control concepts of a NOTAR.			X	X	X			
(03)		Explain the advantages and disadvantages of a NOTAR design.			X	X	X			

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SUBJECT 022 – AIRCRAFT GENERAL KNOWLEDGE – INSTRUMENTATION

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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**								
022 01 01 01		**Units for pressure, sensor types, measurements**								
(01)	X	Define ‘pressure’, ‘absolute pressure’ and ‘differential pressure’.	X	X	X	X	X			
(02)	X	List the following units used for pressure measurement: — Pascal; — bar; — inches of mercury (in Hg); — pounds per square inch (psi).	X	X	X	X	X			
(03)	X	State the relationship between the different units.	X	X	X	X	X			
(04)		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			
(05)		Identify pressure measurements that are applicable to an aircraft: — liquid-pressure measurement (fuel, oil, hydraulic); — air-pressure measurement (bleed-air systems, air-conditioning systems);	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— engine-pressure measurement manifold pressure (MAP), engine pressure ratio (EPR)).								
(06)		Identify and read pressure measurement indications both for engine indications and other systems.	X	X	X	X	X			
(07)		Explain the implications of the following pressure measurement errors both for engine indications and other systems: — loss of pressure sensing; — incorrect pressure indications.	X	X	X	X	X			
022 01 02 00		**Temperature sensing**								
022 01 02 01		**Units for temperature, measurements**								
(01)	X	Explain temperature.	X	X	X	X	X			
(02)	X	List the following units that can be used for temperature measurement: — Kelvin; — Celsius; — Fahrenheit.	X	X	X	X	X			
(03)	X	State the relationship between these units and convert between them.	X	X	X	X	X			
(04)		Identify temperature measurements that are applicable to an aircraft: — gas temperature measurement (ambient air, bleed-air systems, air-conditioning systems, air inlet, exhaust gas, gas turbine outlets); — liquid-temperature measurement (fuel, oil, hydraulic); — component-temperature measurement (generator, transformer rectifier unit (TRU), pumps (fuel, hydraulic), power transfer unit (PTU).	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Identify and read temperature measurement indications for both engine indications and other systems.	X	X	X	X	X			
022 01 03 00		**Fuel gauge**								
022 01 03 01		**Units for fuel, measurements, fuel gauges**								
(01)		State that the quantity of fuel can be measured by volume or mass.	X	X	X	X	X			
(02)		List the following units used for fuel quantity: — kilogramme; — pound; — litres; — gallons (US and imperial).	X	X	X	X	X			
(03)		Convert between the various units.	X	X	X	X	X			
(04)		Explain the parameters that can affect the measurement of the volume or mass of the fuel in a fuel tank: — temperature; — aircraft accelerations and attitudes; — and explain how the fuel-gauge system design compensates for these changes.	X	X	X	X	X			
(05)		Describe and explain the operating principles of the following types of fuel gauges: — float system; — capacitance-type of fuel-gauge system. — ultrasound-type of fuel-gauge system: to be introduced at a later date.	X	X	X	X	X			
(06)		Describe and complete a typical post-refuelling procedure for a pilot: — recording the volume that was filled;	X	X	X	X	X			

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		— converting to the appropriate unit used by the aircraft fuel gauge(s) to compare the actual indicated fuel content to the calculated fuel content; — assess appropriate action if the numbers does not compare.								
022 01 04 00		**Fuel flowmeters**								
022 01 04 01		**Fuel flow, units for fuel flow, total fuel consumption**								
(01)		Define 'fuel flow' and where it is measured.	X	X	X	X	X			
(02)		State that fuel flow may be measured by volume or mass per unit of time.	X	X	X	X	X			
(03)		List the following units used for fuel flow when measured by mass per hour: kilogrammes/hour; pounds/hour.	X	X	X	X	X			
(04)		List the following units used for fuel flow when measured by volume per hour: — litres/hour; — imperial gallons/hour; — US gallons/hour.	X	X	X	X	X			
(05)		Explain how total fuel consumption is obtained.	X	X	X	X	X			
022 01 05 00		**Tachometer**								
022 01 05 01		**Types, operating principles, units for engine speed**								
(01)	X	List the following types of tachometers, describe their basic operating principle and give examples of use: mechanical (rotating magnet); electrical (three-phase tacho-generator); electronic (impulse measurement with speed probe and phonic wheel);	X	X	X	X	X			

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		and describe the operating principle of each type.								
(02)		Explain the typical units for engine speed: — rpm for piston-engine aircraft; — percentage for turbine-engine aircraft.	X	X	X	X	X			
(03)		Explain that some types of rpm indicators require electrical power to provide an indication.	X	X	X	X	X			
022 01 06 00		**Thrust measurement**								
022 01 06 01		**Parameters, operating principle**								
(01)		List and describe the following two parameters used to represent thrust: — N1; — EPR.	X	X						
(02)		Explain the operating principle of using an engine with EPR indication and explain the consequences of incorrect or missing EPR to the operation of the engine, including reverting to N1 mode.	X	X						
(03)		Give examples of display for N1 and EPR.	X	X						
022 01 07 00		**Engine torquemeter**								
022 01 07 01		**Torque, torquemeters**								
(01)		Define ‘torque’.	X	X	X	X	X			
(02)		Explain the relationship between power, torque and rpm.	X	X	X	X	X			
(03)		List the following units used for torque: — Newton meters; — inch or foot pounds.	X	X	X	X	X			
(04)		State that engine torque can be displayed as a percentage.	X	X	X	X	X			
(05)	X	List and describe the following different types of torquemeters, and explain their operating principles:	X	X	X	X	X			

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		— mechanical; — electronic.								
(06)	X	Compare the two systems with regard to design and weight.	X	X	X	X	X			
(07)		Give examples of display.	X	X	X	X	X			
022 01 08 00		**Synchroscope**								
022 01 08 01		**Purpose, operating principle, display**								
(01)		state the purpose of a synchroscope.	X	X						
(02)	X	Explain the operating principle of a synchroscope.	X	X						
(03)		Give examples of display.	X	X						
022 01 09 00		**Engine-vibration monitoring**								
022 01 09 01		**Purpose, operating principle of a vibration-monitoring system, display**								
(01)		State the purpose of a vibration-monitoring system for a jet engine.	X	X						
(02)	X	Describe the operating principle of a vibration-monitoring system using the following two types of sensors: piezoelectric crystal; magnet.	X	X						
(03)		Explain that there is no specific unit for vibration monitoring, i.e. it is determined by specified numeric threshold values.	X	X						
(04)		Give examples of display.	X	X						
022 01 10 00		**Time measurement**								
022 01 10 01		**On-board clock**								
(01)		Explain that the on-board aircraft clock provides a time reference for several of the on-board systems including aircraft communications addressing and reporting system (ACARS) and engine and systems maintenance.	X	X	X	X	X			

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022 02 00 00		**MEASUREMENT OF AIR-DATA PARAMETERS**								
022 02 01 00		**Pressure measurement**								
022 02 01 01		**Definitions**								
(01)		Define the following pressure measurements and state the relationship between them: — static pressure; — dynamic pressure; — total pressure.	X	X	X	X	X	X		
022 02 01 02		**Pitot/static system: design and errors**								
(01)		Describe the design and the operating principle of a: — static port/source; — pitot tube; — combined pitot/static probe.	X	X	X	X	X	X	X	
(02)		For each of these indicate the various locations and describe the following associated errors and how to correct, minimise the effect of or compensate for them: — position errors; — instrument errors; — errors due to a non-longitudinal axial flow (including manoeuvre-induced errors).	X	X	X	X	X	X	X	
(03)		Describe a typical pitot /static system and list the possible outputs.	X	X	X	X	X	X		
(04)		Explain the redundancy and the interconnections that typically exist in complex pitot/static systems found in large aircraft.	X	X	X	X	X	X		
(05)		Explain the purpose of pitot/static system heating.	X	X	X	X	X	X	X	

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(06)		Describe alternative static sources and their effects when used, particularly in unpressurised aircraft.	X	X	X	X	X	X	X	
(07)		Describe a modern pitot static system using solid-state sensors near the pitot probe or static port converting the air data to numerical data (electrical signals) before being sent to the air-data computer(s).	X	X	X	X	X	X		
022 02 02 00		**Temperature measurement**								
022 02 02 01		**Definitions**								
(01)		Define the following and explain the relationship between them: — outside air temperature (OAT); — total air temperature (TAT); — static air temperature (SAT).	X	X	X	X	X	X	X	
(02)		Explain the term ‘ram rise’ and convert TAT to SAT.	X					X		
(03)		Explain why TAT is often displayed and that is the temperature input to the air-data computer.	X	X	X	X	X	X	X	
022 02 02 02		**Design and operation**								
(01)		Indicate typical locations for both direct-reading and remote-reading temperature probes, and describe the following errors: — position error; — instrument error.	X	X	X	X	X	X		
(02)		Explain the purpose of temperature probe heating and interpret the effect of heating on sensed temperature unless automatically compensated for.	X	X	X	X	X	X		
022 02 03 00		**Angle-of-attack (AoA) measurement**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 02 03 01		**Sensor types, operating principles, ice protection, displays, incorrect indications**								
(01)		Describe the following two types of AoA sensors: - null-seeking (slotted) probe; - vane detector.	X	X						
(02)		For each type, explain how the operating principle.	X	X						
(03)		Explain how both types are protected against ice.	X	X						
(04)		Give examples of systems that use the AoA as an input, such as: — air-data computer; — stall warning systems; — flight-envelope protection systems.	X	X						
(05)		Give examples of and interpret different types of AoA displays: — simple light arrays of green, amber and red lights; — gauges showing a numerical scale.	X	X						
(06)		Explain the implications for the pilot if the AoA indication becomes incorrect but still provides data, e.g. if the sensor is frozen in a fixed position.	X	X						
(07)		Explain how an incorrect AoA measurement can affect the controllability of an aircraft with flight-envelope protection.	X	X						
022 02 04 00		**Altimeter**								
022 02 04 01		**Units, terms, types, operating principles, displays, errors, corrections**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		List the following two units used for altimeters and state the relationship between them: — feet; — metres.	X	X	X	X	X	X		
(02)	X	Define the following terms: — height, altitude; — indicated altitude, true altitude; — pressure altitude, density altitude.	X	X	X	X	X	X	X	
(03)	X	Define the following barometric references: ‘QNH’, ‘QFE’, ‘1013.25’.	X	X	X	X	X	X	X	
(04)		Explain the operating principles of an altimeter.	X	X	X	X	X	X	X	
(05)	X	Describe and compare the following three types of altimeters and reason(s) why particular designs may be required in certain airspace: — simple altimeter (single capsule); — sensitive altimeter (multi-capsule); — servo-assisted altimeter.	X	X	X	X	X	X	X	
(06)	X	Give examples of associated displays: pointer, multi-pointer, drum, vertical straight scale.	X	X	X	X	X	X	X	
(07)		Describe the following errors: — static system error; — instrument error; — barometric error; — temperature error (air column not at ISA conditions); — lag (altimeter response to change of height).	X	X	X	X	X	X	X	
(08)		Demonstrate the use of an altimeter correction table for the following errors: — temperature corrections;	X	X	X	X	X	X	X	

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		— aircraft position errors.								
(09)		Describe the effects of a blockage or a leakage on the static pressure line.	X	X	X	X	X	X	X	
(10)		Describe the use of GPS altitude as an alternative means of checking erroneous altimeter indications, and highlight the limitations of the GPS altitude indication.	X	X	X	X	X	X	X	
022 02 05 00		**Vertical speed indicator (VSI)**								
022 02 05 01		**VSI and instantaneous vertical speed indicator (IVSI)**								
(01)		List the two units used for VSIs and state the relationship between them: — metres per second; — feet per minute.	X	X	X	X	X	X		
(02)		Explain the operating principles of a VSI and an IVSI.	X	X	X	X	X	X	X	
(03)		Describe and compare the following types of VSIs: — barometric type (VSI); — instantaneous barometric type (IVSI); — inertial type (inertial information provided by an inertial reference unit).	X	X	X	X	X	X	X	
(04)		Describe the following VSI errors: — static system errors; — instrument errors; — time lag.	X	X	X	X	X	X	X	
(05)		Describe the effects on a VSI of a blockage or a leakage on the static pressure line.	X	X	X	X	X	X	X	
(06)		Give examples of a VSI display.	X	X	X	X	X	X		
(07)		Compare the indications of a VSI and an IVSI during flight in turbulence and appropriate pilot technique during manoeuvring using either type.	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 02 06 00		**Airspeed indicator (ASI)**								
022 02 06 01		**Units, errors, operating principles, displays, position errors, unreliable airspeed indications**								
(01)		List the following three units used for airspeed and state the relationship between them: — nautical miles/hour (kt); — statute miles/hour (mph); — kilometres/hour (km/h).	X	X	X	X	X	X		
(02)		Describe the following ASI errors and state when they must be considered: — pitot/static system errors; — instrument errors; — position errors; — compressibility errors; — density errors.	X	X	X	X	X	X	X	
(03)		Explain the operating principles ASI (as appropriate to aeroplanes or helicopters.)	X	X	X	X	X	X	X	
(04)		Give examples of an ASI display: pointer, vertical straight scale, and digital (HUD display).	X	X	X	X	X	X		
(05)		Demonstrate the use of an ASI correction table for position error.	X	X	X	X	X	X		
(06)		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) or barber's pole (VMO); — blue line (best rate of climb speed, one-engine-out for multi-engine piston light aeroplanes).	X	X						

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Define and explain the following colour codes that can be used on an ASI: — green arc (normal operating speed range); — red line (VNE); — blue line (maximum airspeed during autorotation).			X	X	X			
(08)		Describe the effects on an ASI of a blockage or a leakage in the static or total pressure line(s).	X	X	X	X	X	X	X	
(09)		Define the term ‘unreliable airspeed’ and describe the means by which it can be recognised such as: — different airspeed indications between ASIs; — unexpected aircraft behaviour; — buffeting; — aircraft systems warning; — aircraft attitude.	X	X	X	X	X	X	X	
(10)		Describe the appropriate procedures available to the pilot in the event of unreliable airspeed indications: — combination of a pitch attitude and power setting; — ambient wind noise inside the aircraft; — use of GPS speed indications and the associated limitations.	X	X	X	X	X	X	X	
022 02 07 00		**Machmeter**								
022 02 07 01		**Operating principle, display, CAS, TAS and Mach number**								
(01)		Define ‘Mach number’ and ‘local speed sound’ (LSS). Calculate between LSS, TAS and Mach number.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)	X	Describe the operating principle of a Machmeter.	X							
(03)	X	Explain why a Machmeter does not suffer from compressibility error.	X							
(04)		Give examples of a Machmeter display: pointer, drum, vertical straight scale, digital.	X							
(05)		Describe the effects on a Machmeter of a blockage or a leakage in the static or total pressure line(s).	X							
(06)		Explain the relationship between CAS, TAS and Mach number. Explain how CAS, TAS and Mach number vary in relation to each other during a climb, a descent, or in level flight in different temperature conditions.	X							
(07)		State the existence of maximum operating limit speed (VMO) and maximum operating Mach number (MMO).	X							
(08)		Describe typical indications of MMO and VMO on analogue and digital instruments.	X							
(09)		Describe the relationship between MMO and VMO with change in altitude and the implications of climbing at constant IAS and descending at constant Mach number with respect to the margin to MMO and VMO.	X							
(10)		Describe the implications of climbing or descending at constant Mach number or constant IAS with respect to the margin to the stall speed or maximum speed.	X							

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 02 08 00		**Air-data computer (ADC)**								
022 02 08 01		**Operation principle, data, errors, air-data inertial reference unit**								
(01)		Explain the operating principle of an ADC.	X	X	X	X	X	X		
(02)		List the following possible input data: — TAT; — static pressure; — total pressure; — measured temperature; — AoA; — flaps position; — landing gear position; — stored aircraft data.	X	X	X	X	X	X		
(03)	X	List the following possible output data, as applicable to aeroplanes or helicopters: — IAS; — TAS; — SAT; — TAT; — Mach number; — AoA; — altitude; — vertical speed; — VMO/MMO pointer.	X	X	X	X	X	X		
(04)		Explain how position, instrument, compressibility and density errors can be compensated/corrected to achieve a TAS calculation.	X	X	X	X	X	X		
(05)		Give examples of instruments or systems which may use ADC output data.	X	X	X	X	X	X		
(06)		Explain that an air-data inertial reference unit (ADIRU) is an ADC integrated with an inertial reference unit (IRU), that there will	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		be separate controls for the ADC part and inertial reference (IR) part, and that incorrect selection during failure scenarios may lead to unintended and potentially irreversible consequences.								
(07)	X	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	X	X	X		
(08)		Describe the consequences of the loss of an ADC compared to the failure of individual instruments.	X	X	X	X	X	X		
022 03 00 00		**MAGNETISM – DIRECT-READING COMPASS AND FLUX VALVE**								
022 03 01 00		**Earth's magnetic field**								
022 03 01 01		**Magnetic field, variation, dip**								
(01)		Describe the magnetic field of the earth.	X	X	X	X	X	X		
(02)	X	Explain the properties of a magnet.	X	X	X	X	X	X		
(03)		Define the following terms: — magnetic variation; — magnetic dip (inclination).	X	X	X	X	X	X		
(04)		Describe that a magnetic compass will align itself to both the horizontal (azimuth) and vertical (dip) components of the Earth's magnetic field, thus will not function in the vicinity of the magnetic poles.	X	X	X	X	X	X		
(05)		Demonstrate the use of variation values (given as East/West (E/W) or +/–) to calculate: — true heading to magnetic heading; — magnetic heading to true heading.	X	X	X	X	X	X		
022 03 02 01		**Aircraft magnetic field**								

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 03 02 01		**Permanent magnetism, electromagnetism, deviation**								
(01)	X	Explain the following differences between permanent magnetism and electromagnetism: — when they are present; — what affects their magnitude.	X	X	X	X	X	X		
(02)	X	Explain the principles of 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		
(03)		Explain how permanent magnetism within the aircraft the aircraft structure and electromagnetism from the aircraft system affect the accuracy of a compass.	X	X	X	X	X	X		
(04)		Describe the purpose and the use of a deviation correction card.	X	X	X	X	X	X		
(05)		Demonstrate the use of deviation values (either given as E/W or +/–) from a compass deviation card to calculate: — compass heading to magnetic heading; — magnetic heading to compass heading.	X	X	X	X	X	X	X	
022 03 03 00		**Direct-reading magnetic compass**								
022 03 03 01		**Purpose, errors, timed turns, serviceability**								
(01)		Explain the purpose of a direct-reading magnetic compass	X	X	X	X	X	X		

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(02)		Describe how the direct-reading magnetic compass will only show correct indications during straight, level and unaccelerated flight, and that an error will occur during the following flight manoeuvres (no numerical examples): — acceleration and deceleration; — turning; — during pitch-up or pitch-down manoeuvres.	X	X	X	X	X	X		
(03)		Explain how the use of timed turns eliminates the problem of the turning errors of a direct-reading magnetic compass, and calculate the duration of a rate-1 turn for a given change of heading.	X	X	X	X	X	X		
(04)		Describe the serviceability check for a direct-reading magnetic compass prior to flight, such as: - the physical appearance of the device; - comparing the indication to another known direction such as a different compass or runway direction.	X	X	X	X	X	X	X	
022 02 04 00		**Flux valve**								
022 03 0 4 01		**Purpose, operating principle, locations, errors**								
(01)		Explain the purpose of a flux valve.	X	X	X	X	X	X		
(02)	X	Explain its operating principle.	X	X	X	X	X	X		
(03)		Indicate typical locations of the flux valve(s).	X	X	X	X	X	X		
(04)		Give the remote-reading compass system as example of application for a flux valve.	X	X	X	X	X	X		
(05)		Explain that deviation is compensated for and, therefore, eliminates the need for a deviation correction card.	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain that a flux valve does not suffer from the same magnitude of errors as a direct-reading magnetic compass when turning, accelerating or decelerating and during pitch-up or pitch-down manoeuvres.	X	X	X	X	X	X		
022 04 00 00		**GYROSCOPIC INSTRUMENTS**								
022 04 01 00		**Gyroscope: basic principles**								
022 04 01 01		**Gyroscopic forces, degress of freedom, gyro wander, driving gyroscopes**								
(01)	X	Define a ‘gyro’.	X	X	X	X	X	X	X	
(02)	X	Explain the fundamemntals of the theory of gyroscopic forces.	X	X	X	X	X	X	X	
(03)	X	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	X	
(04)	X	Explain the following terms: — rigidity; — precession; — wander (drift/topple).	X	X	X	X	X	X		
(05)		Explain the three types of gyro wander: — real wander; — apparent wander; — transport wander.	X	X	X	X	X	X		
(06)		Describe the two ways of driving gyroscopes and any associated indications: — air/vacuum; — electrically.	X	X	X	X	X	X	X	
022 04 02 00		**Rate-of-turn indicator – Turn coordinator – Balance (slip) indicator**								

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 04 02 01		**Indications, relation between bank angle, rate of turn and TAS**								
(01)		Explain the purpose of a rate-of-turn and balance (slip) indicator.	X	X	X	X	X	X	X	
(02)		Define a ‘rate-1 turn’.	X	X	X	X	X	X	X	
(03)		Describe the indications given by a rate-of-turn indicator.	X	X	X	X	X	X	X	
(04)		Explain the relation between bank angle, rate of turn and TAS, and how bank angle becomes the limiting factor at high speed (no calculations).	X	X	X	X	X	X	X	
(05)		Explain the purpose of a balance (slip) indicator and its principle of operation.	X	X	X	X	X	X	X	
(06)		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	X	
(07)		Describe the indications given by a turn coordinator (or turn-and-bank indicator).	X	X	X	X	X	X	X	
(08)		Compare the indications on the rate-of-turn indicator and the turn coordinator.	X	X	X	X	X	X	X	
022 04 03 00		**Attitude indicator (artificial horizon)**								
022 04 03 01		**Purpose, types, effect of aircraft acceleration, display**								
(01)		Explain the purpose of the attitude indicator.	X	X	X	X	X	X	X	
(02)		Identify the two types of attitude indicators: — attitude indicator; — attitude and director indicator (ADI).	X	X	X	X	X	X	X	
(03)	X	State the degrees of freedom.	X	X	X	X	X	X		
(04)		Describe the effects of the aircraft’s acceleration and turns on instrument indications.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe a typical attitude display and instrument markings.	X	X	X	X	X	X	X	
022 04 04 00		**Directional gyroscope**								
022 04 04 01		**Purpose, types, drift, alignment of compass heading**								
(01)		Explain the purpose of the directional gyroscope.	X	X	X	X	X	X	X	
(02)		Identify the two types of gyro-driven direction indicators: — direction indicator; — horizontal situation indicator (HSI).	X	X	X	X	X	X	X	
(03)		Explain how the directional gyroscope will drift over time due to the following: — rotation of the Earth; — aircraft manoeuvring; — aircraft movement over the Earth's surface/direction of travel.	X	X	X	X	X	X		
(04)		Describe the procedure for the pilot to align the directional gyroscope to the correct compass heading.	X	X	X	X	X	X		
022 04 05 00		**Remote-reading compass systems**								
022 04 05 01		**Operating principle, components, comparison with a direct-reading magnetic compass**								
(01)		Describe the principles of operation of a remote-reading compass system.	X	X	X	X	X	X	X	
(02)		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;	X	X	X	X	X	X	X	

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— display unit (compass card, synchronising and set-heading knob, DG/compass/slave/free switch).								
(03)		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, automatic flight control system (AFCS)).	X	X	X	X	X	X		
022 04 06 00		**Solid-state systems – attitude and heading reference system (AHRS)**								
022 04 06 01		**Components, indications**								
(01)		Explain that the AHRS is a replacement for traditional gyros using solid-state technology with no moving parts and is a single unit consisting of: — solid-state accelerometers; — solid-state rate sensor gyroscopes; — solid-state magnetometers (measurement of the Earth's magnetic field).	X	X	X	X	X	X	X	
(02)		Explain that the AHRS senses rotation and acceleration for all three axes and senses the direction of the Earth's magnetic field where the indications are normally provided on electronic screens	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		(electronic flight instrument system (EFIS)).								
022 05 00 00		**INERTIAL NAVIGATION**								
022 05 01 00		**Basic principles**								
022 05 01 01		**Systems**								
(01)		State that inertial navigation/reference systems are the main source of attitude and one of the main sources of navigational data in commercial air transport aeroplanes.	X		X	X				
(02)		State that inertial systems require no external input, except TAS, to determine aircraft attitude and navigational data.	X		X	X				
(03)		State that earlier gyro mechanically stabilised platforms are (technically incorrectly but conventionally) referred to as inertial navigation systems (INSs) and more modern fixed (strap down) platforms are conventionally referred to as inertial reference systems (IRSs). INSs can be considered to be stand-alone, whereas IRSs are integrated with the FMS.	X		X	X				
(04)		Explain the basic principles of inertial navigation (including double integration of measured acceleration and the necessity for north–south, east–west and vertical components to be measured/extracted).	X		X	X				
(05)		Explain the necessity of applying correction for transport precession, and Earth rate precession, coriolis and gravity.	X		X	X				
(06)		State that in modern aircraft fitted with inertial reference system (IRS) and flight management system (FMS), the flight management computer (FMC) position is	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		normally derived from a mathematical analysis of IRS, global positioning system (GPS), and distance measuring equipment (DME) data, VHF omnidirectional radio range (VOR) and LOC.								
(07)		List all navigational data that can be determined by a stand-alone inertial navigation system.	X		X	X				
(08)		State that a strap-down system is fixed to the structure of the aircraft and normally consists of three laser ring gyros and three accelerometers.	X		X	X				
(09)		State the differences between a laser ring gyro and a conventional mechanical gyro.	X		X	X				
022 05 02 00		**Alignment and operation**								
022 05 02 01		**Alignment process, incorrect data entry, and control panels**								
(01)		State that during the alignment process, the inertial platform is levelled (INS) or the local vertical is determined (IRS), and true north/aircraft heading is established.	X		X	X				
(02)		Explain that the aircraft must be stationary during alignment, the aircraft position is entered during the alignment phase, and that the alignment process takes around 10 to 20 minutes at mid latitudes (longer at high latitudes).	X		X	X				
(03)		State that in-flight realignment is not possible and loss of alignment leads to loss of navigational data although attitude information may still be available.	X		X	X				
(04)		Explain that the inertial navigation system (INS) platform is maintained level and	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		north-aligned after alignment is complete and the aircraft is in motion.								
(05)		State that an incorrect entry of latitude may lead to a loss of alignment and is more critical than the incorrect entry of longitude.	X		X	X				
(06)		State that the positional error of a stand-alone INS varies (a typical value can be quoted as 1–2 NM/h) and is dependent on the gyro drift rate, accelerometer bias, misalignment of the platform, and computational errors.	X		X	X				
(07)		Explain that, on a modern aircraft, there is likely to be an air-data inertial reference unit (ADIRU), which is an inertial reference unit (IRU) integrated with an air-data computer (ADC).	X		X	X				
(08)		Identify examples of IRS control panels.	X		X	X				
(09)		Explain the following selections on the IRU mode selector: — NAV (normal operation); — ATT (attitude only).	X		X	X				
(10)		State that the majority of the IRS data can be accessed through the FMS control and display unit (CDU)/flight management and guidance system (FMGS) multifunction control and display unit (MCDU).	X		X	X				
(11)		Describe the procedure available to the pilot for assessing the performance of individual IRUs after a flight: — reviewing the residual indicated ground speed when the aircraft has parked; — reviewing the drift given as NM/h.	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 06 00 00		**AEROPLANE: AUTOMATIC FLIGHT CONTROL SYSTEMS**								
022 06 01 00		**General**								
022 06 01 00		**Definitions and control loops**								
(01)		Describe the following purposes of an automatic flight control system (AFCS): — enhancement of flight controls; — reduction of pilot workload.	X	X				X		
(02)		Define and explain the following two functions of an AFCS: - aircraft control: stabilise the aircraft around its centre of gravity (CG); - aircraft guidance: guidance of the aircraft's flight path.	X	X				X		
(03)		Describe the following two automatic control principles: — closed loop, where a feedback from an action or state is compared to the desired action or state; — open loop, where there is no feedback loop.	X	X						
(04)		List the following elements of a closed-loop control system and explain their basic function: — input signal; — error detector; — signal processor providing a measured output signal according to set criteria or laws; — control element such as an actuator; — feedback signal to error detector for comparison with input signal.	X	X						
(05)		Describe how a closed-loop system may enter a state of self-induced oscillation if	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		the system overcompensates for deviations from the desired state.								
(06)		Explain how a state of self-induced oscillations may be detected and describe the effects of self-induced oscillations: — aircraft controllability; — aircraft safety; — timely manual intervention as a way of mitigating loss of control; — techniques that may be used to maintain positive control of the aircraft.	X	X						
022 06 02 00		**Autopilot system**								
022 06 02 01		**Design and operation**								
(01)		Define the three basic control channels.	X	X						
(02)		Define the three different types of autopilots: — single or 1 axis (roll); — 2 axes (pith and roll); — 3 axes (pitch, roll and yaw)	X	X						
(03)		Describe the purpose of the following components of an autopilot system: — flight control unit (FCU), mode control panel (MCP) or equivalent; — flight mode annunciator (FMA) (see Subject 022 06 04 00); — autopilot computer; — actuator.	X	X						
(04)		Explain the following lateral modes: — heading (HDG)/track (TRK); — VOR (VOR)/localiser (LOC); — lateral navigation/managed navigation (LNAV or NAV).	X	X						
(05)		Describe the purpose of control laws for pitch and roll modes.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain the following vertical modes: — vertical speed (V/S); — flight path angle (FPA); — level change (LVL CHG)/open climb (OP CLB) or open descent (OP DES); — speed reference system (SRS); — altitude (ALT) hold; — vertical navigation (VNAV)/managed climb (CLB) or descent (DES); — glideslope (G/S).	X	X						
(07)		Describe how the autopilot uses speed, aircraft configuration or flight phase as a measure for the magnitude of control inputs and how this may affect precision and stability.	X	X						
(08)		Explain the following mixed modes: — take-off; — go-around; — approach (APP).	X	X						
(09)		Describe the two types of autopilot configurations and explain the implications to the pilot for either and when comparing the two principles: — flight-deck controls move with the control surface when the autopilot is engaged; — flight-deck controls remain static when the autopilot is engaged.	X	X						
(10)		Describe the purpose of the following inputs and outputs for an autopilot system: — attitude information; — flight path/trajectory information; — control surface position information; — airspeed information;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— aircraft configuration information; — FCU/MCP selections; — FMAs.								
(11)		Describe the purpose of the synchronisation function when engaging the autopilot and explain why the autopilot should be engaged when the aircraft is in trim.	X	X						
(12)		Define the control wheel steering (CWS) mode as manual manoeuvring of the aircraft through the autopilot computer and autopilot servos/actuators using the control column/control wheel.	X	X						
(13)		Describe the following elements of CWS: — CWS as an autopilot mode; — flight phases where CWS cannot be used; — whether the pilot or the autopilot is controlling the flight path; — the availability of flight path/performance protections; — potential different feel and control response compared to manual flight.	X	X						
(14)		Describe touch control steering (TCS) and highlight the differences when compared to CWS: — autopilot remains engaged but autopilot servos/actuators are disconnected from the control surfaces; — manual control of the aircraft as long as TCS button is depressed; — autopilot servos/actuators reconnect when TCS button is released and the	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		autopilot returns to previously engaged mode(s).								
(15)		Explain that only one autopilot may be engaged at any time except for when APP is armed in order to facilitate a fail-operational autoland.	X	X				X		
(16)		Explain the difference between an armed and an engaged mode: — not all modes have an armed state available; — a mode will only become armed if certain criteria are met; — an armed mode will become engaged (replacing the previously engaged mode, if any) when certain criteria are met.	X	X				X		
(17)		Describe the sequence of events when a mode is engaged and the different phases: — initial phase where attitude is changed to obtain a new trajectory in order to achieve the new parameter; — the trajectory will be based on rate of closure which is again based on the difference between the original parameter and the new parameter; — capture phase where the aircraft will follow a predefined rate of change of trajectory to achieve the new parameter without overshooting/ undershooting; — tracking or hold phase where the aircraft will maintain the set parameter until a new change has been initiated.	X	X				X		
(18)		Explain automatic mode reversion and typical situations where it may occur:	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— no suitable data for the current mode such as flight plan discontinuity when in LNAV/managed NAV; — change of parameter during capture phase for original parameter such as change of altitude target during ALT ACQ/ALT*; — mismanagement of a mode resulting in engagement of the autopilot envelope protection, e.g. selecting excessive V/S resulting in a loss of speed control.								
(19)		Explain the dangers of mismanagement of the following modes: — use of V/S and lack of speed protection, i.e. excessive V/S or FPA may be selected with subsequent uncontrolled loss or gain of airspeed; — arming VOR/LOC or APP outside the protected area of the localiser or ILS.	X	X				X		
(20)		Describe how failure of other systems may influence the availability of the autopilot and how incorrect data from other systems may result in an undesirable aircraft state, potentially without any failure indications. Explain the importance of prompt and appropriate pilot intervention during such events.	X	X				X		
(21)		Explain an appropriate procedure for disengaging the autopilot and why both aural and visual warnings are used to indicate that the autopilot is being disengaged: — temporary warning for intended disengagement using the design method;	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— continuous warning for unintended disengagement or using a method other than the design method.								
(22)		Explain the following regarding autopilot and aircraft with manual trim: — the autopilot may not engage unless the aircraft controls are in trim; — the aircraft will normally be in trim when the autopilot is disconnected; — use of manual trim when the autopilot is engaged will normally lead to autopilot disconnection and a risk of an out-of-trim situation.	X	X				X		
022 06 03 00		**Flight director: design and operation**								
022 06 03 01		**Purpose, use, indications, modes, data**								
(01)		Explain the purpose of a flight director system.	X	X				X		
(02)		Describe the different types of display: — pitch and roll crossbars; — V-bar.	X	X				X		
(03)		Explain the differences between a flight director and an autopilot and how the flight director provides a means of cross-checking the control/guidance commands sent to the autopilot.	X	X				X		
(04)		Explain why the flight director must be followed when engaged/shown, and describe the appropriate use of the flight director: — flight director only; — autopilot only; — flight director and autopilot; — typical job-share between pilots (pilot flying (PF)/pilot monitoring (PM)) for	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		selecting the parameters when autopilot is engaged versus disengaged; — highlight when the flight director should not be followed or should be disengaged.								
(05)		Give examples of different scenarios and the resulting flight director indications.	X	X				X		
(06)		Explain that the flight director computes and indicates the direction and magnitude of control inputs required in order to achieve an attitude to follow a trajectory.	X	X				X		
(07)		Explain how the modes available for the flight director are the same as those available for the autopilot, and that the same panel (FCU/MCP) is normally used for selection.	X	X				X		
(08)		Explain the importance of checking the FMC data or selected autopilot modes through the FMA when using the flight directors. If the flight directors are showing incorrect guidance, they should not be followed and should be turned off.	X	X				X		
022 06 04 00		**Aeroplane: flight modes annunciator (FMA)**								
022 06 04 01		**Purpose, modes, display scenarios**								
(01)		Explain the purpose of FMAs and their importance being the only indication of the state of a system rather than a switch position.	X	X				X		
(02)		Describe where the FMAs are normally shown and how the FMAs will be divided into sections (as applicable to aircraft complexity): — vertical modes; — lateral modes;	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— autothrust modes; — autopilot and flight director annunciators; — landing capability.								
(03)		Explain why FMAs for engaged or armed modes have different colour or different font size.	X	X				X		
(04)		Describe the following FMA display scenarios: — engagement of a mode; — mode change from armed to becoming engaged; — mode reversion.	X	X				X		
(05)		Explain the importance of monitoring the FMAs and announcing mode changes at all times (including when selecting a new mode) and why only certain mode changes will be accompanied by an aural notification or additional visual cues.	X	X				X		
(06)		Describe the consequences of not understanding what the FMAs imply or missing mode changes, and how it may lead to an undesirable aircraft state.	X	X				X		
022 06 05 00		**Autoland**								
022 06 05 01		**Design and operation**								
(01)		Explain the purpose of an autoland system.	X					X		
(02)		Explain the significance of the following components required for an autoland: — autopilot; — autothrust; — radio altimeter; — ILS receivers.	X					X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the following terms (reference to CS-AWO 'All Weather Operations'): — fail-passive automatic landing system; — fail-operational automatic landing system; — fail-operational hybrid landing system; — alert height.	X							
(04)		Describe the autoland sequence including the following: — FMAs regarding the landing capability of the aircraft; — the significance of monitoring the FMAs to ensure the automatic arming/engagement of modes triggered by defined radio altitudes or other thresholds; — in the event of a go-around, that the aircraft performs the go-around manoeuvre both by reading the FMAs and supporting those readings by raw data; — during the landing phase, that 'FLARE' mode engages at the appropriate radio altitude, including typical time frame and actions if 'FLARE' does not engage; — after landing, that 'ROLL-OUT' mode engages and the significance of disconnecting the autopilot prior to vacating the runway.	X							
(05)		Explain that there are operational limitations in order to legally perform an autoland beyond the technical capability of the aircraft.	X							
(06)		Explain the purpose and significance of alert height, describe the indications and	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		implications, and consider typical pilot actions for a failure situation: — above the alert height; — below the alert height.								
(07)		Describe typical failures that, if occurring below the alert height, will trigger a warning: — all autopilots disengage; — loss of ILS signal or components thereof; — excessive ILS deviations; — radio-altimeter failure.	X							
(08)		Describe how the failure of various systems, including systems not directly involved in the autoland process, can influence the ability to perform an autoland or affect the minima down to which the approach may be conducted.	X							
(09)		Describe the fail-operational hybrid landing system as a primary fail-passive automatic landing system with a secondary independent guidance system such as a head-up display (HUD) to enable the pilot to complete a manual landing if the primary system fails.	X							
022 07 00 00		**HELICOPTER: AUTOMATIC FLIGHT CONTROL SYSTEMS**								
022 07 01 00		**General principles**								
022 07 01 01		**Stabilisation**								
(01)		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			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		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.								
022 07 01 02		**Reduction of pilot workload**								
(01)		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**								
(01)		Explain how an AFCS improves helicopter flight safety during: — search and rescue (SAR) 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			
(02)		Explain that the SAR modes of AFCS include the following functions: — ability to autohover; — facility for mark on target (MOT) approach to hover; — automatically transition from cruise down 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 from the hover back to cruise flight; — the ability to fly various search patterns.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain that earlier autohover systems use Doppler velocity sensors and modern systems use inertial sensors plus GPS, and normally include a two-dimensional hover-velocity indicator for the pilots.			X	X	X			
(04)		Explain why some SAR helicopters have both radio-altimeter height hold and barometric altitude hold.			X	X	X			
022 07 01 04		**Failures**								
(01)		Explain the various redundancies and independent systems that are built into the AFCSs.			X	X	X			
(02)		Appreciate that the pilot can overrivde the system in the event of failure.			X	X	X			
(03)		Explain a series actuator ‘hard cover’ which equals aircraft attitude runaway.			X	X	X			
(04)		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**								
(01)		Explain the basic sensors in the system and their functions.			X	X	X			
(02)		Explain that the number of sensors will be dependent on the number of coupled modes of the system.			X	X	X			
022 07 02 02		**Specific sensors**								
(01)		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**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the principles of operation of the series and parallel actuators, spring-box clutches and the autotrim system.			X	X	X			
(02)		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 indications, warnings**								
(01)		Describe the typical layout of the AFCS control panel.			X	X	X			
(02)		Describe the system indications and warnings.			X	X	X			
022 07 02 05		**Operation**								
(01)		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**								
(01)		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			
(02)		Explain and describe the general working principles and primary use of an SAS by damping pitch, roll and yaw motions.			X	X	X			
(03)		Describe a simple SAS with force trim system which uses magnetic clutch and			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		springs to hold cyclic control in the position where it was released.								
(04)		Explain the interaction of trim with SAS/stability and control augmentation system (SCAS).			X	X	X			
(05)		Appreciate that the system can be overridden by the pilot and that individual channels can be deselected.			X	X	X			
(06)		Describe the operational limits of the system.			X	X	X			
(07)		Explain why the system should be turned off in servere turbulence or when extreme flight attitudes are reached.			X	X	X			
(08)		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			
(09)		Explain how cross-coupling procedures an adverse effect on roll-to-yaw coupling when the helicopter is subjected to gusts.			X	X	X			
(10)		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**								
(01)		Explain the general autopilot principles with regard to: — long-term attitude hold; — fly-through; — changing the reference (beep trim, trim release).			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 07 04 02		**Basic modes (3/4 axes)**								
(01)		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)**								
(01)		Explain the function of the attitude-hold system in an AFCS.			X	X	X			
(02)		Explain the function of the heading-hold system in an AFCS.			X	X	X			
(03)		Explain the function of the vertical-speed hold system in an AFCS.			X	X	X			
(04)		Exlain the function of the navigation-coupling system in an AFCS.			X	X	X			
(05)		Explain the function of the VOR-/ILS-coupling system in an AFCS.			X	X	X			
(06)		Explain the function of the hover-mode system in an AFCS (including Doppler and radio-altimeter systems).			X	X	X			
(07)		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**								
(01)		Explain the purpose of alight director system.			X	X	X			
(02)		Describe the different types of display: — pitch and roll crossbars; — V-bar.			X	X	X			
(03)		State the difference between the flight director system and the autopilot system. Explain how each can be used independently.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		List and describe the main components of the flight director system.			X	X	X			
(05)		Give examples of different situations with the respective indications of the command bars.			X	X	X			
(06)		Explain the architecture of the different flight directors fitted to helicopters and the importance to monitor other instruments as well as the flight director.			X	X	X			
(07)		Explain how some helicopter types have the collective setting as a flight director command; however, the command does not provide protection against a transmission overtorque.			X	X	X			
(08)		Describe the collective setting and yaw depiction on flight director for some helicopters.			X	X	X			
022 07 04 05		**Automatic flight control panel (AFCP)**								
(01)		Explain the purpose and the importance of the AFCP.			X	X	X			
(02)		State that the AFCP provides: — AFCS basic and upper modes; — flight director 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**								
022 08 01 01		**Design and operation**								
(01)		Explain the purpose of the trim system and describe the layout with one trim system for each control axis, depending on the complexity of the aircraft.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Give examples of trim indicators and their function, and explain the significance of a 'green band/area' for the pitch trim.	X	X						
(03)		Describe and explain an automatic pitch-trim system for a conventional aeroplane.	X	X						
(04)		Describe and explain an automatic pitch-trim system for an FBW aeroplane and that it is also operating during manual flight; however, during certain phases it may be automatically disabled to alter the handling characteristics of the aircraft.	X	X						
(05)		Describe the consequences of manual operation on the trim wheel when the automatic pitch-trim system is engaged.	X	X						
(06)		Describe and explain the engagement and disengagement conditions of the autopilot according to trim controls.	X	X						
(07)		Define ‘Mach trim’ and state that the Mach-trim system can be independent.	X	X						
(08)		Describe the implications for the pilot in the event of a runaway trim or significant out-of-trim state.	X	X						
022 08 02 00		**Yaw damper**								
022 08 02 01		**Design and operation**								
(01)		Explain the purpose of the yaw-damper system.	X	X						
(02)		Explain the purpose of the Dutch-roll filter (filtering of the yaw input signal).	X	X						
(03)		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)**								
022 08 03 01		**Purpose, input parameters, functions**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the purpose of the FEP.	X	X				X		
(02)		Explain typical input parameters to the FEP: — AoA; — aircraft configuration; — airspeed information.	X	X				X		
(03)		Explain the following functions of the FEP: — stall protection; — overspeed protection.	X	X				X		
(04)		Explain how the stall-protection function and the overspeed-protection function apply to both mechanical/conventional and FBW control systems, but other functions (e.g. pitch or bank limitation) can only apply to FBW control systems.	X	X				X		
022 09 00 00		**AUTOTHRUST – AUTOMATIC THRUST CONTROL SYSTEM**								
022 09 01 00		**Autothrust system**								
022 09 01 00		**Purpose, operation, overcompensation, speed control**								
(01)		Describe the purpose of the autothrust system and explain how the FMAs will be the only indication on active autothrust modes.	X							
(02)		Explain the operation of an autothrust system with regard to the following modes: — take-off/go-around (TOGA); — climb or maximum continuous thrust (MCT), N1 or EPR targeted (THR CLB, THR MCT, N1, THR HOLD, EPR); — speed (SPEED, MCP SPD); — idle thrust (THR IDLE, RETARD/ARM); — landing (RETARD, THR IDLE).	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe the two main variants of autothrust systems: — mode selections available on the FCU/MCP and thrust levers move with autothrust commands; — mode selections made using the thrust levers which remain static during autothrust operation.	X							
(04)		Explain how flight in turbulence/wind shear giving fluctuating airspeed indications may lead to the autothrust overcompensating in an oscillating manner and that manual thrust may be required to settle the airspeed. Airspeed indications/trend vectors may give an indication of appropriate thrust adjustments but any reaction should not be too aggressive.	X							
(05)		Explain the threats associated with the use of autothrust resulting in the pilot losing the sense of energy awareness (e.g. speed, thrust).	X							
(06)		Explain the relationship between autopilot pitch modes and autothrust modes, and how the autopilot and autothrust will interact upon selecting modes for one of the systems.	X							
(07)		Explain the principles of speed control and how speed can be controlled: — by varying the engine thrust; — by varying the aircraft pitch.	X							
(08)		Explain the potential implications on speed control when the autothrust controls speed and the autopilot pitch channel has	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		a fixed pitch target for the following mode combinations: — MCP SPD/SPEED and ALT HOLD/ALT; — MCP SPD/SPEED and VSP (climb); — MCP SPD/SPEED and VSP (descent).								
(09)		Explain the potential implications on speed control when the autothrust has a fixed thrust target and the autopilot pitch channel controls speed for the following mode combinations: — N1/THR CLB and LVL CHG/OP CLB; — ARM/THR IDLE and LVL CHG/OP DES.	X							
022 10 00 00		**COMMUNICATION SYSTEMS**								
022 10 01 00		**Voice communication, data-link transmission**								
022 10 01 01		**Definitions and transmission modes**								
(01)		Describe the purpose of a data-link transmission system.	X		X	X				
(02)		Compare voice communication versus data-link transmission systems.	X		X	X				
(03)		Describe the communication links that are used in aircraft: — high-frequency (HF) communications; — very high-frequency (VHF) communications; — satellite communications (SATCOM).	X		X	X				
(04)		Consider the properties of the communication links with regard to: — signal quality; — range/area coverage; — range; — line-of-sight limitations;	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— quality of the signal received; — interference due to ionospheric conditions; — data transmission speed.								
(05)		Define and explain the following terms in relation to aircraft data-link communications: — message/data uplink; — message/data downlink.	X		X	X				
022 10 01 02		**Systems: architecture, design and operation**								
(01)		Describe the purpose of the ACARS network.	X							
(02)		Describe the systems using the ACARS network through the air traffic service unit (ATSU) suite: — aeronautical/airline operational control (AOC); — air traffic control (ATC).	X							
(03)		Explain the purpose of the following parts of the on-board equipment: — ATSU communications computer; — control and display unit (CDU)/multifunction control and display unit (MCDU); — data communication display unit (DCDU); — ATC message visual annunciator; — printer.	X							
(04)		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);	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— load sheet; — passenger information (connecting flights); — weather reports (METAR, TAF); — maintenance reports (engine exceedances); — aircraft technical data; — free-text messages.								
(05)		Give examples of ATC data-link messages such as: — departure clearance; — oceanic clearance; — digital ATIS (D-ATIS); — controller–pilot data-link communications (CPDLC).	X							
022 10 02 00		**Future air navigation systems (FANSs)**								
022 10 02 01		**Versions, applications, CPDLC messages, ADS contracts**								
(01)		Describe the existence of the ICAO communication, navigation, surveillance/air traffic management (CNS/ATM) concept.	X							
(02)		Explain the two versions of FANSs: — FANS A/FANS 1 using the ACARS network; — FANS B/FANS 2 using the ACARS network and the aeronautical telecommunication network (ATN).	X							
(03)		List and explain the following FANS A/FANS 1 applications: — ATS facility notification (AFN); — automatic dependent surveillance (ADS); — CPDLC.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Compare the ADS application with the secondary surveillance radar function, and the CPDLC application with VHF communication systems.	X							
(05)		State that an ATCU can use the ADS application only, or the CPDLC application only, or both of them (not including AFN).	X							
(06)		Describe the AFN process for logging on with an ATCU and typical data that will be included in the message.	X							
(07)		Describe typical types of CPDLC messages and the typical pilot work practices when requesting or accepting a CPDLC clearance.	X							
(08)		List and describe the different types of ADS contracts that are controlled by the ATCU and beyond the control of the pilot: — periodic: data sent at set time intervals; — on demand: data sent when requested; — on event: data sent when an event occurs (e.g. heading change, climb initiated, etc.); — emergency mode.	X							
(09)		Describe the purpose of the ADS emergency mode contract and highlight the difference to the ATCU controlled contracts.	X							
022 11 00 00		**FLIGHT MANAGEMENT SYSTEM (FMS)/ FLIGHT MANAGEMENT AND GUIDANCE SYSTEM (FMGS)**								
022 11 01 00		**Design**								
022 11 01 01		**Purpose, architecture, failures, functions**								
(01)		Explain the purpose of an FMS.	X		X	X		X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe a typical dual FMS architecture including the following components: — flight management computer (FMC); — CDU/MCDU; — cross-talk bus.	X		X	X				
(03)		Describe the following failures of a dual FMS architecture and explain the potential implications to the pilots: — failure of one FMC; — failure of one CDU/MCDU; — failure of the cross-talk bus.	X		X	X				
(04)		Describe how the FMS integrates with other systems and gathers data in order to provide outputs depending on its level of complexity.	X		X	X		X		
(05)		Explain how the FMS may provide the following functions: — navigation; — lateral and vertical flight planning; — performance parameters.	X	X	X	X		X		
022 11 02 00		**FMC databases**								
022 11 02 01		**Navigation database**								
(01)		Explain the purpose of, and describe typical content of, the navigation database.	X		X	X		X	X	
(02)		Describe the 28-day aeronautical information regulation and control (AIRAC) update cycle of the navigation database and explain the reason for having two navigation databases (one active, one standby) and the implication this has to the pilot.	X		X	X		X	X	
(03)		Explain the purpose of typical user-defined waypoints such as:	X		X	X		X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— latitude/longitude coordinates; — place/bearing/distance (PBD); — place/bearing place/bearing (PBX); — place/distance (PD).								
(04)		Explain that the pilot cannot change or overwrite any of the data in the navigation database and that any user-defined waypoints, routes and inputted data will be erased when a different database is activated.	X		X	X		X	X	
(05)		Explain the threats and implications to the pilot of changing the database by error either on the ground or while flying.	X		X	X		X		
022 11 02 02		**Aircraft performance database**								
(01)		Explain the purpose of, and describe the typical content of, the aircraft performance database.	X		X	X		X		
(02)		Explain the importance of verifying that the aircraft performance database is based on the correct data, such as engine type and aircraft variant.	X		X	X		X		
(03)		Explain that the contents of the aircraft performance database cannot be modified by the pilot.	X		X	X		X		
(04)		Explain the purpose of performance factor and how it influences the calculations.	X		X	X		X		
(05)		Explain the purpose of cost index (CI) and how it influences the calculations.	X							
022 11 03 00		**Operations, limitations**								
022 11 03 01		**Data, calculations, position inputs, raw data**								
(01)		Describe typical data that may be provided by the FMS: — lateral and vertical navigation guidance;	X		X	X		X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— present position; — time predictions; — fuel predictions; — altitude/flight level predictions.								
(02)		Explain how the FMS will use a combination of inputted/database and measured data in order to calculate projections and provide output data.	X		X	X		X		
(03)		Explain the issues and threats using inputted/database data and give examples of consequences of inputting data incorrectly/using incorrect data.	X		X	X		X		
(04)		Describe fuel consumption calculations during standard operations and explain typical data that will have an influence on the accuracy of the calculations.	X		X	X				
(05)		Explain the implications on the accuracy of the calculations during flight in abnormal configurations (such as engine out, gear down, flaps extended, spoilers extended, etc.) if the FMS is unable to detect the failure.	X		X	X				
(06)		Describe and explain the purpose of an FMS having dedicated radio-navigation receivers that it will tune automatically.	X		X	X				
(07)		Explain typical position inputs to an FMS: — GPS; — IRS; — DME; — VOR; — LOC; — runway threshold (RWY THR).	X		X	X			X	
(08)		Explain how the FMS will create its own FMS position fix and that the FMS	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		calculations will be based on the FMS position. Depending on the type of system, the FMS position may be calculated from: — a single source of position data where the most accurate data available at a given time will be used; — multiple sources from which a position will be derived using the combined inputs.								
(09)		Explain the implications of a reduction in available position inputs to the FMS, especially GPS in relation to the capability of performing RNP/PBN approaches.	X		X	X				
(10)		Explain the difference between following the FMS data compared to following raw data from radio-navigation receivers and describe how there may be limitations for using FMS data as primary source to follow an instrument approach procedure (IAP) such as LOC, VOR or NDB.	X		X	X		X		
022 11 04 00		**Human-machine interface (control and display unit (CDU)/ malfunction control unit and display unit (MCDU))**								
022 11 04 01		**Purpose, scratchpad, data input, set-up process**								
(01)		Describe the purpose of a CDU/MCDU.	X		X	X		X		
(02)		Describe the typical layout of a CDU/MCDU and the general purpose of the following: — screen; — line select keys; — menu select keys; — alphanumerical keys.	X		X	X		X		
(03)		Explain the function of the ‘scratchpad’ part of the screen.	X		X	X		X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Describe how input of some data is compulsory for the function of the FMS and other data is optional, and that different symbology is used to highlight this: — rectangular boxes = compulsory information; — dashed line = optional information.	X		X	X		X		
(05)		Describe a typical FMS pre-flight set-up process through the CDU/MCDU to cover the most basic information (with the aim to create awareness of required information as this is irrespective of aircraft type and FMS/FMGS make): — ident page (who am I = aircraft type/variant, engine type/rating and appropriate navigation database); — position initialisation (where am I = position for aligning the IRS and FMS position); — route initialisation (where am I going to = place of departure/destination and alternate(s)); — route programming (how will I get there = SIDs, STARS, route (company or otherwise)); — performance initialisation (when will I arrive = weights, flap setting, FLEX/assumed temperature/derate, take-off speeds).	X							
022 12 00 00		**ALERTING SYSTEMS, PROXIMITY SYSTEMS**								
022 12 01 00		**General**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 12 01 01		**Alerting systems according to CS-25 and CS-29**								
(01)		State definitions, category, criteria and characteristics of alerting systems according to CS-25/AMC 25.1322 for aeroplanes and CS-29 for helicopters as appropriate.	X	X	X	X	X			
022 12 02 00		**Flight warning systems (FWSs).**								
022 12 02 01		**Annunciations, master warning, master caution, advisory**								
(01)		State the annunciations given by the FWS and typical location for the annunciator(s): — master warning; — master caution; — advisory.	X	X	X	X	X	X		
(02)		Explain master warning: — colour of annunciator: red; — nature of aural alerts: continuous; — typical failure scenarios triggering the alert.	X	X	X	X	X	X		
(03)		Explain master caution: — colour of the annunciator: amber or yellow; — nature of aural alerts: attention-getter; — typical failure scenarios triggering the alert.	X	X	X	X	X	X		
(04)		Describe a typical procedure following a master warning or master caution alert: — acknowledging the failure; — silencing the aural warning; — initiating the appropriate response/procedure	X	X	X	X	X	X		
(05)		Explain advisory:	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— colour of the annunciator: any other than red, amber, yellow or green; — absence of aural alert; — typical scenarios triggering the advisory.								
022 12 03 00		**Stall warning systems (SWSs)**								
022 12 03 01		**Function, types, components**								
(01)		Describe the function of an SWS and explain why the warning must be unique.	X	X						
(02)		Describe the different types of SWSs.	X	X						
(03)		List the main components of an SWSs.	X	X						
(04)		Explain the difference between the stall warning speed and the actual stalling speed of the aeroplane.	X	X						
022 12 04 00		**Stall protection**								
022 12 04 01		**Function, types**								
(01)		Describe the function of a stall protection system.	X							
(02)		Describe the different types of stall protection systems including the difference between mechanical and FBW controls.	X							
(03)		Explain the difference between an SWS and a stall protection system.	X							
022 12 05 00		**Overspeed warning**								
022 12 05 01		**Purpose, aural warning, V_{MO}/M_{MO} pointer**								
(01)		Explain the purpose of an overspeed warning system (V_{MO}/M_{MO} pointer).	X	X						
(02)		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						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe and give examples of V_{MO}/M_{MO} pointer: barber's/barber pole pointer, barber's/barber pole vertical scale.	X	X						
022 12 06 00		**Take-off warning**								
022 12 06 01		**Purpose**								
(01)		Explain 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**								
022 12 07 01		**Function, displays, alerts**								
(01)		Describe the function of an altitude alert system.	X	X	X	X	X	X		
(02)		Describe different types of displays and possible alerts.	X	X	X	X	X	X		
022 12 08 00		**Radio altimeter**								
022 12 08 01		**Purpose, range, displays, incorrect indications**								
(01)		Explain the purpose of a low-altitude radio altimeter.	X	X	X	X	X	X		
(02)		Describe the principle of the distance (height) measurement.	X	X	X	X	X	X		
(03)		Describe the different types of radio-altimeter displays.	X	X	X	X	X	X		
(04)		Describe how the radio altimeter provides input to other systems and how a radio-altimeter failure may impact on the functioning of these systems.	X	X	X	X	X	X		
(05)		State the range of a radio altimeter.	X	X	X	X	X	X		
(06)		Explain the potential implications of a faulty radio-altimeter and how this in particular may affect the following systems: — autothrust (flare/retard);	X	X				X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— ground-proximity warning systems (GPWSs).								
022 12 09 00		**Ground-proximity warning systems (GPWSs)**								
022 12 09 01		**GPWSs: design, operation, indications**								
(01)		Explain the purpose of GPWSs.	X		X	X				
(02)		Explain inputs and outputs of a GPWS and describe its operating principle.	X		X	X				
(03)		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)**								
(01)		Explain the purpose of a TAWS for aeroplanes and of a HTWAS for helicopters, and explain the difference from a GPWS.	X		X	X				
(02)		Explain inputs and outputs od a TAWS/HTWAS and describe its working principle.	X		X	X				
(03)		Give examples of terrain displays and list the different possible alerts.	X		X	X				
(04)		Give examples of time response left to the pilot according to look-ahead distance, speed and aircraft performances.	X		X	X				
(05)		Explain the TAWS/HTAWS must be coupled to a precise-position sensor.	X		X	X				
(06)		Explain the possibility of triggering spurious TAWS/HTAWS warnings as a result of mismanaging the flight path in the proximity to obstacles: — high rate of descent; — high airspeed;	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— a combination of high rate of descent and high airspeed.								
022 12 09 03		**Intentionally left blank**								
022 12 10 00		**ACAS/TCAS**	X	X	X	X	X	X		
022 12 10 01		**Principles and operations**								
(01)		State that ACAS II is an ICAO standard for anti-collision purposes.	X	X	X	X	X	X		
(02)		Explain that ACAS II is an anti-collision system and does not guarantee any specific separation.	X	X	X	X	X	X		
(03)		Describe the purpose of an ACAS II system as an anti-collision system.	X	X	X	X	X	X		
(04)		Describe the following outputs from a TCAS: — other intruders; — proximate intruders; — traffic advisory (TA); — resolution advisory (RA).	X	X	X	X	X	X		
(05)		State that ACAS II will issue commands in the vertical plane only (climb, descent or maintain), and that the commands are complied with as a manual manoeuvre.	X	X	X	X	X	X		
(06)		Explain that an RA may or may not require any active control input and the implications of reacting instinctively without awareness of actual control inputs required to comply with the RA.	X	X	X	X	X	X		
(07)		Explain that if two aircraft are fitted with ACAS II, the RA will be coordinated.	X	X	X	X	X	X		
(08)		State that ACAS II equipment can take into account several threats simultaneously.	X	X	X	X	X	X		
(09)		State that a detected aircraft without altitude-reporting can only generate a TA; describe typical type of traffic and how this	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		can create distractions during flight in certain areas of significant air traffic activity.								
(10)		Describe the interaction between the TCAS II system and the transponder, radio altimeter and the air-data computer: — antenna used; — computer and links with radio altimeter, air-data computer and mode-S transponder.	X	X	X	X	X	X		
(11)		Explain the principle of TCAS II interrogations.	X	X	X	X	X	X		
(12)		State the typical standard detection range for TCAS II: — 35–40 NM horizontally; — approximately 2 000 ft above and below (any setting); — extension to approximately 10 000 ft above (ABV selected) or approximately 10 000 ft below (BLW selected).	X	X	X	X	X	X		
(13)		Explain the principle of 'reduced surveillance'.	X	X	X	X	X	X		
(14)		Explain that in high-density traffic areas the range may automatically be decreased in order to enable detection of the threats in the proximity of the aircraft due to a limitation of the maximum number of possible intruders the system is able to process.	X	X	X	X	X	X		
(15)		Identify the equipment which an intruder must be fitted with in order to be detected by TCAS II.	X	X	X	X	X	X		
(16)		Explain in the anti-collision process:	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— the criteria used to trigger an alarm (TA or RA) are the time to reach the closest point of approach (CPA) (called TAU) and the difference of altitude; — an intruder will be classified as 'proximate' when being less than 6 NM and 1 200 ft from the TCAS-equipped aircraft; — 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; — in case of an RA, the intended vertical separation varies from 300 to 600 ft (700 ft above FL420), depending on the SL; — below 1 000 ft above ground, no RA can be generated; — below 1 450 ft (radio-altimeter value) 'increase descent' RA is inhibited; — at high altitude, performances of the type of aircraft are taken into account to inhibit 'climb' and 'increase climb' RA.								
(17)		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		
(18)		Explain the indications of a TA and an RA and how an RA will generate a red area on the VSI. Some variants will also include a	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		green area. To manoeuvre the aircraft to comply with the RA, the pilot should 'avoid the red' or 'fly the green'.								
(19)		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**								
(01)		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**								
(01)		List the different technologies used, e.g. CRT and LCD, and the associated limitations: — cockpit temperature; — glare; — resolution.	X	X	X	X	X	X	X	
022 13 02 00		**Mechanical integrated instruments**								
022 13 02 01		**Attitude and director indicator (ADI)/ horizontal situation indicator (HSI)**								
(01)		Describe an ADI and an HSI.	X	X	X	X	X	X	X	
022 13 03 00		**Electronic flight instrument systems (EFFSs)**								
022 13 03 01		**Design, operation**								
(01)		List the following parts of an EFIS: — control panel; — display units; — symbol generator; — remote light sensor.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the typical layout of the EFIS display units and how there may be a facility to transfer the information from one display unit on to another if a display unit fails.	X	X	X	X	X	X		
(03)		Explain the need for standby instruments to supplement the EFIS in the event of all the display units failing and the challenge of using these standby instruments, namely their size and position on the flight deck.	X	X	X	X	X	X		
(04)		Explain the difference between a symbol generator failing and a display unit failing, and the implications if there are redundant symbol generators available.	X	X	X	X	X	X		
(05)		Describe the purpose of an EFIS control panel and typical selections that may be available: — altimeter pressure setting; — navigation display (ND) mode selector; — ND range selector; — ND data selector (waypoints, facilities, constraints, data, etc.); — radio-navigation aids selector (VOR 1/2 or ADF 1/2); — decision altitude (DA)/decision height (DH) selection.	X	X	X	X	X	X		
022 13 03 02		**Primary flight display)PFD), electronic attitude director indicator (EADI)**								
(01)		Describe that a PFD (or an EADI) presents a dynamic colour display of all the parameters necessary to control the aircraft, and that the main layout conforms with the ‘basic T’ principle:	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— attitude information in the centre; — airspeed information on the left; — altitude information on the right; — heading/track indication lower centre; — flight mode annunciation; — basic T; — take-off and landing reference speeds; — minimum airspeed; — lower selectable airspeed; — Mach number.								
(02)		Describe the typical design of the attitude information: artificial horizon with aircraft symbol; superimposed flight director command bars.	X	X	X	X	X	X	X	
(03)		Describe the typical design of the speed tape: — rolling speed scale with numerical read-out of current speed; — limiting airspeeds according to configuration; — speed trend vector; — bug/indication for selected airspeed.	X	X	X	X	X	X	X	
(04)		Explain the Mach number indications and how a selected Mach number is presented with the speed bug on a corresponding IAS on the speed tape with the Mach number shown as a numerical indication outside the speed tape	X							
(05)		Describe the typical design of the altitude information: — rolling altitude scale with numerical read-out of current altitude; — altimeter pressure setting;	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— bug/indication for selected altitude; — means of highlighting the altitude if certain criteria are met.								
(06)		Describe the typical design of the heading/track information: — rolling compass scale/rose with numerical read-out of current heading/track; — bug/indication for selected heading/track.	X	X	X	X	X	X	X	
(07)		Describe the typical design and location of the following information: — flight mode annunciators (FMAs); — vertical speed indicator including TCAS RA command indications; — radio altitude; — ILS localiser/glideslope and RNP/PBN, GBAS or SBAS horizontal/vertical flight path deviation indicator; — decision altitude/height (DA/H).	X	X	X	X	X	X	X	
022 13 03 03		**Navigation display (ND), electronic horizontal situation indicator (EHSI)**								
(01)		Describe that an ND (or an EHSI) provides a mode-selectable colour flight ND.	X	X	X	X	X	X	X	
(02)		List the following four modes typically available to be displayed on an ND unit: — MAP (or ARC); — VOR (or ROSE VOR); — APP (or ROSE LS); — PLAN.	X	X	X	X	X	X		
(03)		List and explain the following information that can be displayed with the MAP (or ARC) mode selected on an ND unit:	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— aircraft symbol, compass scale and range markers; — current heading and track (either one may be 'up' depending on selection), true or magnetic; — selected heading and track; — TAS/GS; — wind direction and speed (W/V); — raw data radio magnetic indicator (RMI) needles/pointers for VOR/automatic direction-finding equipment (ADF), if selected, including the frequency or ident of the selected navigation facility; — route/flight plan data from the FMS; — TO/next waypoint data from the FMS; — data from the navigation database such as airports, waypoints or navigation facilities as selected; — weather radar information; — TCAS traffic information (no TCAS commands); — TAWS (EGPWS) terrain information; — failure flags and messages.								
(04)		List and explain the following information that can be displayed with the VOR or APP (or ROSE VOR or ROSE LS) mode selected on an ND unit: — aircraft symbol and compass scale; — current heading and track (either one may be 'up' depending on selection), true or magnetic; — selected heading and track; — TAS/ground speed (GS); — wind direction and speed (W/V);	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— VOR or ILS frequency and identification of the selected navigation aid; — VOR selected course, deviation indicator and a TO/FROM indicator in a HSI-type display format when in VOR mode; — localiser selected course, deviation indicator and glideslope indicator in a HSI-type display format when in APP mode. — weather radar information; — TCAS traffic information (no TCAS commands); — TAWS (EGPWS) terrain information; — failure flags and messages.								
(05)		List and explain the following information that can be displayed with the PLAN mode selected on an ND unit: — north-up compass rose and range markers; — aircraft symbol oriented according to aircraft heading; — TAS/GS; — wind direction and speed (W/V); — route/flight plan data from the FMS; — TO/next waypoint data from the FMS; — data from the navigation database such as airports, waypoints or navigation facilities as selected; — failure flags and messages.	X	X	X	X	X	X		
(06)		Explain the purpose of PLAN mode and its characteristics such as: — no compass information; — north is up on the display unit at all times;	X	X	X	X	X	X		

EASA UNEDITED

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— the centre waypoint is the selected waypoint on the FMS CDU; — scrolling through the flight plan on the FMS CDU will shift the map view along the flight path; — the aircraft symbol will be positioned in the appropriate place along the flight path; — using PLAN mode as the primary mode during flight may lead to disorientation and loss of situational awareness.								
(07)		Distinguish the difference between the appearance of an EXPANDED or FULL/ROSE mode and how the displayed range differs between them.	X	X	X	X	X	X		
(08)		Explain the combination of mode and range selection including how selecting the appropriate range and displayed data can improve situational awareness for a given phase of flight.	X	X	X	X	X	X		
022 13 04 00		**Engine parameters, crew warnings, aircraft systems, procedure and mission display systems**								
022 13 04 01		**Purpose of systems, display systems, checklists**								
(01)		State the purpose of the following systems: — engine instruments centralised display unit; — crew alerting system/aircraft display unit; — facility for appropriate on-screen checklists; — that the aircraft systems display unit enables the display of normal and	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		degraded modes of operation of the aircraft systems; — that the systems/aircraft display unit is able to show pictorial systems diagrams/schematics and associated parameters.								
(02)		Describe the similarities to EFIS with regard to basic system architecture.	X		X	X				
(03)		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 (EICASs); — engine and warning display (EWD); — electronic centralised aircraft monitor (ECAM); — systems display (S/D).	X							
(04)		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				
(05)		State the purpose of mission display unit.			X	X				
(06)		Describe the architecture of each system and give examples of display.			X	X				
(07)		Explain why awareness of the consequences of the actions commanded by the automatic checklist is required.	X		X	X				
(08)		Explain the limited ability of the computer to assess a situation other than using the	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		exceedance of certain thresholds to trigger the main and subsequent events and programmed actions.								
(09)		Describe an appropriate procedure for following an on-screen checklist associated with a failure scenario including the following: — confirm the failure with the other flight crew member prior to performing any of the actions; — seek confirmation prior to manipulating any guarded switches or thrust levers; — follow the checklist slowly and methodically; — assess the possible implications of making certain selections, such as opening the fuel cross-feed if there is a fuel leak even though the electronic checklist may ask for the action.	X		X	X				
022 13 05 00		**Engine first limit indicator**								
022 13 05 01		**Design, operation, information on display**								
(01)		Describe the principles of design and operation, and compare the different indications and displays available.			X	X	X			
(02)		Describe what information can be displayed on the screen, when the screen is in the limited composite mode.			X	X	X			
022 13 06 00		**Electronic flight bag (EFB)**								
022 13 06 01		**Purpose, certification, malfunctions**								
(01)		Explain the purpose of the EFB and list typical equipment: — computer laptop; — tablet device;	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— integrated avionics suite in the aircraft.								
(02)		Describe the 'class' hardware certification: — portable: portable electronic device (PED) that can be used inside or outside the aircraft, is not part of the certified aircraft configuration and does not require tools to remove it from the flight-deck cradle, if one exists; — installed: an electronic device that is considered an aircraft part covered by the aircraft airworthiness approval, thus is a minimum equipment list (MEL) item in the event of failure.	X		X	X				
(03)		Describe the 'type' software certification: — type A: applications whose misuse or malfunctions have no adverse effect on flight safety; — type B: applications for which evaluation of the hazards presented by misuse or malfunctions is required.	X		X	X				
(04)		Explain implications of malfunctions with the EFB installation in a fully electronic flight-deck environment: — mass and balance calculations; — performance calculations; — access to charts; — access to manuals.	X		X	X				
022 13 07 00		**Head-up display (HUD), synthetic vision system (SVS) and enhanced visual system (EVS)**	X		X	X				
022 13 07 01		**Components, benefits, modes of operation**								
		State the components of a typical HUD installation:	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— HUD projector and stowable combiner; — HUD controls such as declutter and dimmer; — HUD computer.								
		Explain the reasons and benefits of having an HUD: — increased situational awareness due to reduced need to look inside to view primary flight information; — lower minima for both departure and landing; — improved accuracy of flying thus reduced susceptibility to enter a state of aircraft upset.	X		X	X				
		Describe how the HUD replicates the information on the primary flight display (PFD) by showing the following data: — altitude; — speed, including speed trend; — heading; — flight path vector (track and vertical flight path); — flight mode annunciator (FMA); — CAS, TAWS and wind shear command annunciations.	X		X	X				
		Describe the following modes of operation of an HUD: — normal display mode that may automatically adapt the information based on the phase of flight; — declutter function.	X		X	X				
		Describe the principle of SVS:	X		X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— an enhanced database used as reference to provide terrain and ground features to be shown on the PFD; — limitations due to being a synthetic image not based on actual sensory information thus not lowering landing minima; — implications if aircraft position accuracy becomes reduced.								
		Describe the principle of EVS: — includes external sensors such as infrared cameras to generate a real-time image on the PFD or on the HUD; — limitation of the fact that an infrared camera uses temperature and temperature difference in order to produce an image; — enables lower minima because of the real-time image, thus enhancing the visibility as experienced by the pilot.	X		X	X				
022 14 00 00		**MAINTENANCE, MONITORING AND RECORDING SYSTEMS**								
022 14 01 00		**Cockpit voice recorder (CVR)**								
022 14 01 01		**Purpose, components, parameters**								
(01)		Describe the purpose of a CVR, its typical location, and explain the implications of knowingly erasing or tampering with any information or equipment.	X	X	X	X	X			
(02)		List the main components of a CVR: — a shock-resistant tape recorder or digital storage associated with an underwater locating beacon (ULB); — a cockpit area microphone (CAM);	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— a control unit with the following controls: auto/on, test and erase, and a headset jack; — limited flight-deck controls such as erase and test switches.								
(03)		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, if installed.	X	X	X	X	X			
022 14 02 00		**Flight data recorder (FDR)**								
022 14 02 01		**Purpose, components, parameters**								
(01)		Describe the purpose of an FDR and its typical location.	X	X						
(02)		List the main components of an FDR: — a shock-resistant data recorder associated with a ULB; — a data interface and acquisition unit; — a recording system (digital flight data recorder); — two control units (start sequence, event mark setting); — limited flight-deck controls, but includes an event switch.	X	X						
(03)		List the following main parameters recorded on the FDR:	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— time or relative time count; — attitude (pitch and roll); — airspeed; — pressure altitude; — heading; — normal acceleration; — propulsive/thrust power on each engine and flight-deck thrust/power lever position, if applicable; — flaps/slats configuration or flight-deck selection; — ground spoilers or speed brake selection.								
(04)		State that additional parameters can be recorded according to FDR capacity and applicable operational requirements.	X							
022 14 03 00		**Maintenance and monitoring systems**								
022 14 03 01		**Helicopter operations monitoring program (HOMP): design, operation, performance**								
(01)		Describe the HOMP as a helicopter version of the aeroplane flight data monitoring (FDM) program.			X	X				
(02)		State that the HOMP software consists of three integrated modules: — flight data events (FDEs); — flight data measurements (FDMs); — flight data traces (FDTs).			X	X				
(03)		Describe and explain the information flow of an HOMP.			X	X				
(04)		Describe HOMP operation and management processes.			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 14 03 02		**Integrated health and usage monitoring system (IHUMS): design, operation, performance**								
(01)		Describe the main features of an IHUMS: — rotor system health; — cockpit voice recorder (CVR)/flight data recorder (FDR); — gearbox system health; — engine health; — exceedance monitoring; — usage monitoring; — transparent operation; — ground station features; — monitoring; — rotor track and balance; — engine performance trending; — quality controlled to level 2.			X	X				
(02)		Describe the ground station features of an IHUMS.			X	X				
(03)		Summarise the benefits of an IHUMS including: — reduced risk of catastrophic failure of rotor or gearbox; — improved rotor track and balance giving lower vibration levels; — accurate recording of flight exceedances; — CVR/FDR allows accurate accident/incident investigation and HOMP; — maintenance cost savings.			X	X				
(04)		State the benefits of an IHUMS and an HOMP.			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
022 14 03 03		**Aeroplane condition monitoring system (ACMS): general, design, operation**								
(01)		State the purpose of an ACMS.	X							
(02)		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							
(03)		State that maintenance messages sent by an ACMS can be transmitted without crew notification.	X							
(04)		Explain that data from the ACMS can be used as part of an FDM and safety programme.	X							
(05)		Explain that the FDM program collects data anonymously; however, grave exceedance of parameters may warrant a further investigation of the event by the operator.	X							
(06)		Explain the purpose of FDM as a system for identifying adverse safety trends and tailoring training programmes in order to enhance the overall safety of the operation.	X							
022 15 00 00		**DIGITAL CIRCUITS AND COMPUTERS**								
022 15 01 00		**Digital circuits and computers**								
022 15 01 01		**General, definitions and design**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Define a ‘computer’ as a machine for manipulating data according to a list of instructions.	X		X	X		X	X	
(02)		Explain the term ‘bus’ being used as a term for a facility (wiring, optical fibre, etc.) transferring data between different parts of a computer, both internally and externally.	X		X	X		X	X	
(03)		Define the terms ‘hardware’ and ‘software’.	X		X	X		X	X	
(04)	X	With the help of the relevant 022 references, give examples of airborne computers and list the possible peripheral equipment for each system, such as: — ADC with pitot probe(s), static port(s) and indicators; — FMS with GPS, CDU/MCDU and ND; — GPWS with radio altimeter, ADC and ND.	X		X	X		X	X	

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SUBJECT 031 – FLIGHT PERFORMANCE AND PLANNING: MASS AND BALANCE – AEROPLANES/HELICOPTERS

Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

(1) DEFINITIONS OF MASSES, LOADS AND INDEXES

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. Example units:
— SI: N/m_2, kg/m_2;
— Non-SI: psi, lb/ft_2.

Basic empty mass (BEM)
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 (DOM)
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).

Dry operating index (DOI)
The aircraft index at dry operating mass.

Index
An index is a moment reduced in a numerical value by an index formula.

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In-flight mass/gross mass
The mass of an aircraft in flight at a specified time.

Landing mass
The mass of an 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 an aircraft at landing under normal circumstances.

Maximum structural mass
The maximum permissible total mass of an 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 an aircraft at commencement of take-off.

Maximum (structural) taxi mass or maximum (structural) ramp mass
The maximum permissible total mass of an aircraft at commencement of taxiing.

Maximum zero fuel mass
The maximum permissible mass of an aircraft with no usable fuel.

Minimum mass (applicable to helicopters only)
The minimum permissible total mass for specific helicopter operations.

Operating mass
The dry operating mass plus take-off fuel.

Payload
The total mass of passengers, baggage and cargo but excluding any non-revenue load.

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Performance-limited landing mass
The mass subject to the destination airfield limitations.

Performance-limited take-off mass
The take-off mass subject to departure airfield limitations.

Ramp mass
See 'taxi 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. Example units:
— 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 an aircraft including everything and everyone carried at the commencement of the take-off for helicopters and take-off run for aeroplanes.

Taxi mass or ramp mass
The mass of an 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.

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
030 00 00 00		**FLIGHT PEFORMANCE AND PLANNING**								
031 00 00 00		**MASS AND BALANCE – AEROPLANES/HELICOPTERS**								
031 01 00 00		**Mass limitations**								
031 01 01 00		**Importance with regard to structural limitations**								
(01)	X	Describe the relationship between aircraft mass and structural stress. Remark: See also Subject 021 01 01 00.	X	X	X	X	X			
(02)	X	Describe why 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.								
(01)		Describe the relationship between aircraft mass and aircraft performance.	X	X	X	X	X			
(02)	X	Describe why aircraft mass must be limited to ensure adequate aircraft performance.	X	X	X	X	X			
031 01 02 00		**Centre-of-gravity (CG) limitations**								
031 01 02 01		**Importance with regard to stability and controllability** Remark: See also Subjects 081/082								
(01)	X	Describe the relationship between CG position and stability/controllability of the aircraft.	X	X	X	X	X			
(02)		Describe the consequences if CG is in front of the forward limit.	X	X	X	X	X			
(03)		Describe the consequences if CG is behind the aft limit.	X	X	X	X	X			
031 01 02 02		**Importance with regard to performance.**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Remark: See also Subjects 032/034								
(01)	X	Describe the relationship between CG position and aircraft performance.	X	X	X	X	X			
(02)		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**								
(01)	X	Define the following mass terms: — basic empty mass; — dry operating mass; — operating mass; — take-off mass; — landing mass; — ramp/taxi 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.								
(01)	X	Define the following load terms: — payload/traffic load; — block fuel; — taxi fuel; — take-off fuel; — trip fuel; — reserve fuel (contingency, alternate, final reserve and additional fuel); — extra fuel.	X	X	X	X	X			
(02)		Explain the relationship between the various load-and-mass components listed in 031 02 01 01 and 031 02 01 02.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Calculate the mass of particular components from other given components.	X	X	X	X	X			
(04)		Convert fuel mass, fuel volume and fuel 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**								
(01)	X	Define the maximum zero fuel mass.	X	X						
(02)	X	Define the maximum ramp/taxi mass.	X							
(03)	X	Define the maximum take-off mass.	X	X	X	X	X			
(04)	X	Define the maximum in-flight (gross) mass with external load.			X	X	X			
(05)	X	Define the maximum landing mass.	X	X	X	X	X			
031 02 02 02		**Performance and regulated limitations**								
(01)		Describe the following performance and regulated mass 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 02		**Cargo compartment limitations**								
(01)	X	Describe the maximum floor load (maximum load per unit of area.)	X	X	X	X	X			
(02)	X	Describe the 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**								
(01)		Calculate the maximum mass for take-off (regulated take-off mass) given mass-and-load components and structural/ performance limits.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Calculate the maximum mass for landing (regulated landing mass) given mass-and-load components and structural/ performance limits.	X	X	X	X	X			
(03)		Calculate the allowed mass for take-off.	X	X	X	X	X			
031 02 03 02		**Allowed traffic load and fuel load**								
(01)		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			
(02)		Calculate 'under load' given the 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**								
(01)	X	Extract the appropriate standard masses for passengers, baggage and crew from relevant documents or operator requirements.	X	X	X	X	X			
(02)		Calculate the traffic load by using standard masses.	X	X	X	X	X			
031 03 00 00		**INTENTIONALLY LEFT BLANK**								
031 04 00 00		**MASS-AND-BALANCE DETAILS OF AIRCRAFT**								
031 04 01 00		**Content of mass-and-balance documentation**								
031 04 01 01		**Datum, moment arm**								
(01)	X	State where the datum and moment arms for aircraft can be found.	X	X	X	X	X			
(02)	X	Extract the appropriate data from given documents.	X	X	X	X	X			
(03)	X	Define 'datum' (reference point), 'moment arm' and 'moment'.	X	X	X	X	X			
031 04 01 02		**CG position as distance from datum**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	State where the CG position for an aircraft at basic empty mass can be found.	X	X	X	X	X			
(01)	X	State where the CG position for an aircraft at basic empty mass can be found.	X	X	X	X	X			
(02)	X	State where the CG limits for an aircraft can be found.	X	X	X	X	X			
(03)		Describe the different forms in presenting CG position as distance from datum or other references.	X	X	X	X	X			
(04)		Explain the meaning of centre of gravity (CG).	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 Subject 081 01 01 05.								
(01)		Extract MAC information from aircraft documents.	X	X						
(02)		Explain the principle of using % MAC for the description of the CG position.	X	X						
(03)		Calculate the CG position as % MAC.	X	X						
031 04 01 04		**Longitudinal CG limits**								
(01)		Extract the appropriate data from given sample documents.	X	X	X	X	X			
031 04 01 05		**Lateral CG limits**								
(01)		Extract the appropriate data from given sample documents.			X	X	X			
031 04 01 06		**Details of passengers and cargo compartments**								
(01)		Extract the appropriate data (e.g. seating schemes, compartment dimensions and limitations) from given sample documents.	X	X	X	X	X			
031 04 01 07		**Details of fuel system relevant to mass-and-balance considerations**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Extract the appropriate data (e.g. fuel-tank capacities and fuel-tank positions) from given sample documents.	X	X	X	X	X			
(02)		Explain aircraft CG movement as flight progresses given location of fuel tank (inner wing, outer wing, central, additional aft central, horizontal stabiliser) and mass of fuel consumed from that tank and aeroplane's previous CG.	X							
(03)		Explain advantages and risks associated with fuel tanks in the aeroplane's fin or horizontal stabiliser.	X							
031 04 02 00		**Determination of aircraft empty mass and CG position by weighing**								
031 04 02 01		**Weighing of aircraft (general aspects)**								
(01)		Describe the general procedure and regulations relating to when an aircraft should be weighed, reweighed or data recalculated. *Remark: See the applicable operational requirements.*	X	X	X	X	X			
(02)	X	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**								
(01)		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 (BEM) and CG data from aircraft documentation**								
031 04 03 01		**BEM or dry operating mass (DOM)**								
(01)	X	Extract values for BEM or DOM from given documents.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
031 04 03 02		**CG position or moment at BEM/DOM**								
(01)	X	Extract values for CG position and moment at BEM or DOM from given documents.	X	X	X	X	X			
031 04 03 03		**Deviations from standard configuration**								
(01)		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**								
(01)		Calculate the CG position of an aircraft by using the formula: CG position = sum of moments / total mass.	X	X	X	X	X			
031 05 01 02		**Graphic method**								
(01)		Determine the CG position of an aircraft by using the loading graphs given in sample documents.	X	X	X	X	X			
031 05 01 03		**Index method**								
(01)	X	Explain the principle of the index method.	X	X	X	X	X			
(02)		Define the terms ‘index’ and ‘dry operating index’ (DOI), and calculate the DOI given the relevant formula and data.	X	X	X	X	X			
(03)		Explain 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**								
(01)	X	Explain the principle and the purpose of load sheets.	X	X						
(02)	X	Explain the principle and the purpose of trim sheets.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain 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**								
(01)	X	Explain the principle and the purpose of load sheets.	X	X						
(02)	X	Explain the principle and the purpose of trim sheets.	X							
031 05 02 02		**Load sheet/balance schedule and CG envelope for light aeroplanes and for helicopters**								
(01)		Add loading data and calculate masses in a sample load sheet/balance schedule.	X	X	X	X	X			
(02)		Calculate moments and CG positions.	X	X	X	X	X			
(03)		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**								
(01)		Complete a sample load sheet to determine the 'allowed mass for take-off', 'allowed traffic load' and 'under load'.	X							
(02)		Explain the purpose of each load section.	X							
(03)		Explain that the purpose of boxed maximum figures in load sheet sections is to cross-check the actual and limiting mass values.	X							
(04)		Complete and cross-check a sample load sheet.	X							
031 05 02 04		**Trim sheet for large aeroplanes**								
(01)		Explain the purpose of the trim sheet and the methods to determine the CG position.	X							
(02)		Check if the zero fuel mass CG or index is within the limits.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Determine the fuel mass CG or index is within the limits.	X							
(04)		Check that the take-off mass CG or index are within the limits.	X							
(05)		Determine 'stabiliser trim units' for take-off.	X							
(06)		Explain the difference between certified and operational CG limits.	X							
(07)		Determine the zero fuel mass CG or index.	X							
(08)		Explain the relationship between pitch control and CG position and the operational significance.	X							
031 05 02 05		**Intentionally left blank**								
031 05 02 06		**Other methods to present load and trim information**								
(01)	X	Describe information from other methods of presenting load and balance information, e.g. aircraft communications addressing and reporting system (ACARS), electronic flight bags (EFBs), and the 'less paper in the cockpit' (LPC) software.	X							
031 05 03 00		**Repositioning of CG**								
031 05 03 01		**Repositioning of CG by shifting the load**								
(01)		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			
(02)		Calculate the distance to move a given mass to establish a defined CG position.	X	X	X	X	X			
(03)	X	Describe the methods to check that cargo has been loaded in correct position in relation to the loading manifest, including	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		identifying hazard of cargo loaded in reverse order (visual inspection of one or more unit load devices (ULDs).								
(04)		Determine whether CG remains within limits if cargo has been loaded in incorrect order or at incorrect location.	X	X						
031 05 03 02		**Repositioning of CG by additional load or ballast or by load or ballast removal**								
(01)		Calculate the amount of additional load or ballast to be loaded at or removed from a given position or compartment to establish a defined CG position.	X	X	X	X	X			
(02)		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**								
031 06 01 01		**Types of cargo (general aspects)**								
(01)		Describe the typical types of cargo, e.g. containerised cargo, palletised cargo, bulk cargo, and the advantages of containerised and palletised cargo.	X	X	X	X	X			
031 06 02 00		**Floor-area load and running-load limitations**								
031 06 02 01		**Floor-area load and running -load limitations in cargo compartments.**								
(01)		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			
(02)		Calculate the maximum mass of a container with given floor-contact area to avoid exceeding the maximum	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		permissible floor load of a cargo compartment.								
(03)		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**								
031 06 03 01		**Securement of load (reasons and methods)**								
(01)		Explain the reasons to restrain or secure cargo and baggage.	X	X	X	X	X			
(02)		Describe the basic methods to restrain or secure loads (unit load devices secured by latches on roller tracks or to tie down points by straps; bulk cargo restrained by restraining nets attached to attachment points and tie-down points).	X	X	X	X	X			

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SUBJECT 032 – FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – AEROPLANES

Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

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.

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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		**Applicability of airworthiness requirements of CS-23 and CS-25**								
(01)	X	Describe the application of certification specification (CSs) with regard to the different kinds of aeroplanes.	X	X						
(02)	X	Describe the general differences between aeroplanes certified according to CS-23 (CS 23.1, CS 23.3) and CS-25 (CS 25.1, CS 25.20).	X							
032 01 01 02		**Operational regulations and safety**								
(01)	X	Describe the basic concept that the applicable operational requirements differ depending on aeroplane performance.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the performance classes for commercial air transport according to the applicable operational requirements.	X	X						
031 01 01 03		**Performance and safety**								
(01)	X	State that aeroplane performance required for commercial air transport may limit the weight of a dispatched aeroplane in order to achieve a sufficient level of safety.	X	X						
(02)	X	Describe that the minimum level of safety required for commercial air transport is ensured through the combination of airworthiness requirements and operational limitations, i.e. the more stringent airworthiness requirements of CS-25 enable a wider range of operating conditions for these aeroplanes.	X	X						
032 01 01 04		**Performance definitions and safety factors**								
(01)	X	Describe measured performance and explain how it is determined.	X	X						
(02)		Describe gross performance.	X	X						
(03)		Describe net performance and safety factors.	X	X						
(04)	X	Describe that the size of a safety factor depends on the likelihood of the event and the range of the measured performance data.	X	X						
(05)		Describe the relationship between net and gross take-off and landing distances, and net and gross climb and descent gradients.	X	X						
032 01 02 00		**General performance theory**								
032 01 02 01		**Intentionally left blank**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
032 01 02 02		**Definitions and terms**								
(01)	X	Define the terms ‘climb angle’ and ‘climb gradient’.	X	X						
(02)	X	Define the terms ‘flight-path angle’ and ‘flight-path gradient’.	X	X						
(03)	X	Define the terms ‘descent angle’ and ‘descent gradient’.	X	X						
(04)	X	Explain the difference between climb/descent angle and flight-path angle.	X	X						
(05)	X	Define ‘absolute ceiling’.	X	X						
(06)		Describe ‘clearway’ and ‘stopway’ according to CS-Definitions.	X	X						
(07)		Describe: — take-off run available (TORA); — take-off distance available (TODA); — accelerate-stop distance available (ASDA); and determine each from given data or appropriate aerodrome charts.	X	X						
(08)		Describe ‘screen height’ including its various values.	X	X						
(09)	X	Define the terms ‘range’ and ‘endurance’.	X	X						
(10)		Define an aeroplane’s ‘specific range’ (SR) in terms of nautical air miles (NAM) per unit of fuel, and ‘specific range over the ground’ (SR_G) in terms of nautical ground miles (NGM) per unit of fuel.	X	X						
(11)		Define the power available and power required.	X	X						
032 01 02 03		**Variables influencing performance**								
(01)	X	Name the following factors that affect aeroplane performance: pressure altitude and temperature, wind, aeroplane weight, aeroplane configuration, aeroplane anti-	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		skid status, aeroplane centre of gravity (CG), aerodrome runway surface, and aerodrome runway slope.								
(02)	X	Describe how, for different density altitudes, the thrust and power available vary with speed for a propeller-driven aeroplane.	X	X						
(03)	X	Describe how, for different density altitudes, the thrust and power available vary with speed for a turbojet aeroplane.	X							
(04)		Describe how, for different density altitudes, the drag and power required vary with indicated airspeeds (IAS) and true airspeeds (TAS).	X	X						
(05)		Describe how, for different aeroplane weights and configurations, the drag and power required vary with IAS and TAS.	X	X						
032 01 03 00		**Level flight, range and endurance**								
032 01 03 01		**Steady level flight**								
(01)	X	Explain how drag (thrust) and power required vary with speed in straight and level flight.	X	X						
(02)	X	Explain the effect of excess thrust and power on speed in level flight.	X	X						
(03)		Interpret the ‘thrust/power required’ and ‘thrust/power available’ curves in straight and level flight.	X	X						
(04)		Describe how the maximum achievable straight and level flight IAS and TAS vary with altitude.	X	X						
(05)		Describe situations in which a pilot may elect to fly for ‘maximum endurance’ or ‘maximum range’.	X	X						
032 01 03 02		**Range**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Define a turbojet aeroplane's specific fuel consumption (SFC) and describe how it affects fuel flow and specific range.	X							
(02)		Define a propeller-driven aeroplane's SFC and describe how it affects fuel flow and specific range.	X	X						
(03)		Explain the optimum speed for maximum SR for a turbojet aeroplane in relation to the drag curve.	X							
(04)		Explain the optimum speed to achieve maximum SR for a propeller-driven aeroplane in relation to the power required and drag graphs.	X	X						
(05)		Explain the effect of aeroplane weight and CG position on fuel consumption, range and the optimum speed for maximum SR.	X	X						
(06)		State how a turbojet engine's SFC varies with temperature and thrust setting.	X							
(07)		Explain how SR for a turbojet aeroplane varies with altitude and under different meteorological conditions.	X							
(08)		Explain how SR_G for a propeller-driven aeroplane varies with altitude and under different meteorological conditions.	X	X						
(09)		Explain the effect of weight on the optimum altitude for maximum range.	X	X						
(10)		Describe the effect of wind on SR_G and the optimum speed for SR_G, when compared to SR, and the optimum speed for SR.	X	X						
032 01 03 03		**Maximum endurance**								
(01)		Explain fuel flow in relation to TAS and thrust for a turbojet aeroplane.	X							
(02)		State the speed for maximum endurance for a turbojet aeroplane.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain fuel flow in relation to TAS and thrust for a propeller-driven aeroplane.	X	X						
(04)		State the speed for maximum endurance for a propeller-driven aeroplane and the disadvantages of holding at this speed (e.g. high angle of attack (AoA) and lack of speed stability).	X	X						
(05)		Explain the effect of wind and altitude on endurance, and the maximum endurance speed for a turbojet aeroplane.	X							
(06)		Explain the effect of wind and altitude on endurance, and the maximum endurance speed for a propeller-driven aeroplane.	X	X						
(07)		Describe the benefits of managing your en-route airspeed to reduce or avoid holding time, and the operational situations when it could be used (commanded by the pilot or air traffic control (ATC), when delays at arrival airport occur).	X	X						
032 01 04 00		**Climbing**								
032 01 04 01		**Climbing (climb performance)**								
(01)		Resolve the forces during a steady climb.	X	X						
(02)		Define and explain the following terms: — critical engine; — speed for best angle of climb (VX); — speed for best rate of climb (VY).	X	X						
(03)		Explain climb performance in relation to the thrust available and thrust required (angle of climb), and power available and power required (rate of climb).	X	X						
(04)		Explain the meaning and effect of ‘excess thrust’ and ‘excess power’ in a steady climb.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Interpret the 'thrust/power required' and 'thrust/power available' curves in a steady climb.	X	X						
(06)		State the difference between climb angle and gradient.	X	X						
(07)		Explain the effect of weight on the climb angle and rate of climb, and the speed for best angle and best rate of climb.	X	X						
(08)		Explain the effects of pressure altitude and temperature, including an inversion on climb performance (angle and rate of climb).	X	X						
(09)		Explain the effect of configuration on climb performance (angle and rate of climb, and V_X and V_Y).	X	X						
(10)		Describe the effect of engine failure on climb performance (angle and rate of climb, and V_X and V_Y).	X	X						
(11)		Calculate the all-engine and one-engine-out climb gradient from given values of engine thrust and aeroplane drag and weight.	X	X						
032 01 05 00		**Descending**								
032 01 05 01		**Descending (descent performance)**								
(01)		Resolve the forces during steady descent and in the glide.	X	X						
(02)		Explain descent performance in relation to thrust available and thrust required (drag), and power available and power required.	X	X						
(03)		Explain the meaning of 'excess thrust required' (excess drag) and 'excess power required' in a steady descent.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Interpret the 'thrust/power required' and 'thrust/power available' curves in a steady descent.	X	X						
(05)		Explain the effect of mass, altitude, wind, speed and configuration on the glide descent.	X	X						
(06)		Explain the effect of mass, altitude, wind, speed and configuration on the powered descent.	X	X						
032 02 00 00		**CS-23/APPLICABLE OPERTIONAL REQUIREMENTS PERFORMANCE CLASS B – THEORY**								
032 02 01 00		**Airworthiness requirements**								
032 02 01 01		**Airworthiness requirements and definitions**								
(01)	X	Define the following speeds: — stall speeds V_S, V_{S0} and V_{S1}; — rotation speed V_R; — speed at 50 ft above the take-off surface level; — reference landing speed V_{REF}.	X	X						
(02)		Describe the limitations on VR, on the speed at 50 ft above the take-off surface and on VREF, and given the appropriate stall speed, estimate the values based on these limitations for a single-engine, class B aeroplane.	X	X						
(03)		Describe the limitations on VR, on the speed at 50 ft above the take-off surface and on VREF, and given the appropriate stall speed, estimate the values based on these limitations for a multi-engine, class B aeroplane.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)	X	Describe the European Union airworthiness requirements according to CS-23 relating to aeroplane performance (CS-23 SUBPART A — GENERAL, PERFORMANCE, CS 23.45 to CS 23.78 inclusive).	X	X						
(05)		Define and identify the critical engine of a multi-engine propeller aeroplane.	X	X						
(06)		Explain the effect of an engine failure on the power required, the total drag (thrust required) and climb performance of a multi-engine aeroplane.	X	X						
(07)		Explain the effect of engine failure on the minimum control speed of a multi-engine aeroplane under given conditions (temperature and pressure altitude).	X	X						
032 02 02 00		**Intentionally left blank**								
032 02 03 00		**Take-off and landing**								
032 02 03 01		**Take-off and landing (definitions and effects)**								
(01)	X	Define the following distances and masses: — take-off distance; — landing distance; — ground-roll distance; — maximum allowed take-off mass; — maximum allowed landing mass.	X	X						
(02)		Explain the effect of flap-setting on the take-off, landing and ground-roll distances.	X	X						
(03)		Explain the effects of the following runway (RWY) variables on take-off distances: — RWY slope;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— RWY surface conditions: dry, wet and contaminated; — RWY elevation.								
(04)		For both fixed-pitch and constant-speed propeller aeroplanes, explain the effect of airspeed on thrust during the take-off run.	X	X						
(05)		Describe the effects of brake release before take-off power is set on the TOD and ASD.	X	X						
(06)		Explain the effect of wind on take-off and landing distances, and determine the actual headwind/tailwind component given the runway direction, wind speed and direction, by use of wind component graphs, mathematical calculations, and rule of thumb.	X	X						
(07)		Explain why an aeroplane has maximum crosswind limit(s) and determine the crosswind component given the runway direction, wind speed and direction, by use of wind component graphs, mathematical calculations, and rule of thumb.	X	X						
(08)		Explain the percentage of accountability for headwind and tailwind components during take-off and landing calculations.	X	X						
(09)		Explain the effect of runway conditions on the landing distance.	X	X						
(10)		Explain the effects of pressure altitude and temperature on the take-off distance, take-off climb, landing distance and approach climb.	X	X						
(11)		Describe the landing airborne distance and ground-roll distance and estimate the effect on the landing distance when the	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		aeroplane is too fast or too high at the screen.								
(12)		Describe the take-off flight path for a multi-engine, class B aeroplane.	X	X						
(13)		Describe the dimensions of the take-off flight path accountability area (domain).	X	X						
032 02 04 00		**Climb, cruise and descent**								
032 02 04 01		**Climb, cruise and descent (requirements and calculations)**								
(01)		Describe the climb and en-route requirements according to the applicable operational requirements.	X	X						
(02)		For a single-engine aeroplane, calculate the expected obstacle clearance (in visual meteorological conditions (VMC)) given gross climb performance, obstacle height and distance from reference zero.	X	X						
(03)		For a single-engine aeroplane, calculate the net glide gradient and net glide distance, given aeroplane altitude, terrain elevation, gross gradient or lift/drag ratio (L/D ratio), and headwind or tailwind component.	X	X						
032 03 00 00		**CS-23/APPLICABLE OPERATIONAL REQUIREMENTS PERFORMANCE CLASS B — USE OF AEROPLANE PERFORMANCE DATA FOR SINGLE- AND MULTI-ENGINE AEROPLANES**								
032 03 01 00		**Intentionally left blank**								
032 03 02 00		**Intentionally left blank**								
032 03 03 00		**Use of aeroplane performance data**								
032 03 03 01		**Take-off**								
(01)		Determine the field-length-limited take-off mass and take-off speeds given	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		defactored distance, configuration, pressure altitude, temperature and headwind/tailwind component.								
(02)		Determine the accelerate-go distance and accelerate-stop distance data.	X	X						
(03)		Determine the ground-roll distance and take-off distance from graphs.	X	X						
(04)		Determine the all-engine-out and critical-engine-out take-off climb data.	X	X						
(05)		Determine take off flight path for a MEP aeroplane of given mass and given airfield conditions, and calculate the obstacle clearance based on the take-off flight path.	X	X						
(06)		Determine the minimum headwind or maximum tailwind component required for take-off for a given mass and given airfield conditions.	X	X						
(07)		Given take-off run available (TORA), TODA and ASDA, slope and surface conditions, calculate the defactored distance to be used for commercial air transport using the appropriate take-off graphs.	X	X						
(08)		Calculate the minimum TORA or TODA for commercial air transport given the defactored take-off distance or run, runway surface and slope.	X	X						
032 03 03 02		**Climb**								
(01)		Determine rate of climb.	X	X						
(02)		Calculate obstacle clearance climb rate.	X	X						
(03)		Determine the still-air and flight-path gradients for given IAS, altitude, temperature, aeroplane weight and, if relevant, wind component.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
032 03 03 03		**Intentionally left blank**								
032 03 03 04		**Landing**								
(01)		Determine the field-length-limited landing mass and landing speeds given defactored distance, configuration, pressure altitude, temperature and headwind or tailwind component.	X	X						
(02)		Determine landing climb data in the event of balked landing.	X	X						
(03)		Determine landing distance and ground-roll distance for given flap position, aeroplane weight and airfield data.	X	X						
(04)		Calculate, given the landing distance available (LDA), slope and surface type and condition, the defactored distance to be used for commercial air transport using the appropriate landing graphs.	X	X						
(05)		Calculate the minimum landing distance (LD) that must be available for commercial air transport given the defactored landing distance, runway surface and slope.	X	X						
032 04 00 00		**CS-25/APPLICABLE OPERATIONAL REQUIREMENTS PERFORMANCE CLASS A – THEORY**								
032 04 01 00		**Take-off**								
032 04 01 01		**Take-off performance, definitions of and relationships between terms**								
(01)	X	Explain the forces affecting the aeroplane during the take-off run.	X							
(02)	X	State the effects of thrust-to-weight ratio and flap-setting on ground roll.	X							
(03)		Describe the European Union airworthiness requirements according to CS-25 relating to large aeroplane	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		performance (General and Take-off) (SUBPART B — FLIGHT PERFORMANCE: CS 25.101 to CS 25.109 inclusive, and CS 25.113).								
(04)		Describe the terms 'aircraft classification number' (ACN) and 'pavement classification number' (PCN), and the requirements and hazards of operating on aerodrome surfaces with PCNs smaller than the ACNs.	X							
(05)		Define and explain the following speeds in accordance with CS-25 or CS-Definitions: — reference stall speed (V_{SR}); — reference stall speed in a specific configuration (V_{SR1}); — 1-g stall speed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight (V_{S1g}); — minimum control speed with critical engine inoperative (V_{MC}); — minimum control speed on or near the ground (V_{MCG}); — minimum control speed at take-off climb (V_{MCA}); — engine failure speed (V_{EF}); — take-off decision speed (V_1); — rotation speed (V_R); — take-off safety speed (V_2); — minimum take-off safety speed (V_{2MIN}); — minimum unstick speed (V_{MU}); — lift-off speed (V_{LOF}); — maximum brake energy speed (V_{MBE}); — maximum tyre speed ($V_{Max\ Tyre}$).								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain the interdependence between the above-mentioned speeds where relevant.	X							
(07)		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							
(08)		Explain how loss of TORA due to alignment is accounted for.	X							
(09)		Explain the effect of the interdependency of relevant speeds in 032 04 01 01 (05) and the situations in which these interdependencies can cause speed and performance restrictions.	X							
032 04 01 02		**Take-off distances**								
(01)		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							
(02)		Explain the effects of the following aeroplane variables on take-off distance: — aeroplane mass; — take-off configuration; — bleed-air configurations.	X							
(03)		Explain the effects of the following meteorological variables on take-off distances: — wind;								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— temperature; — pressure altitude.								
(04)		Explain the consequence 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							
(05)		Compare the take-off distance for specified conditions and configuration for all engines operating and one-engine-inoperative.	X							
(06)		Explain the effect of using clearway on the field-length-limited take-off mass.	X							
(07)		Explain the influence of aeroplane mass, air density and flap settings on V_1, V_2 and V_{2MIN} and thereby on take-off distance.	X							
(08)		Explain the effect of an error in V1 on the resulting one-engine-out take-off distance.	X							
032 04 01 03		**Accelerate-stop distance**								
(01)		Explain how the accelerate-stop distance is affected by given conditions and configuration for all engines operating and one-engine-inoperative.	X							
(02)		Explain the effect of using a stopway on the field-length-limited take-off mass.	X							
(03)		Explain the effect of an error in V1 on the resulting accelerate-stop distance.	X							
(04)		Explain the effect of runway slope or wind component on the accelerate-stop distance.	X							
(05)		Explain how the accelerate-stop distance is determined and discuss the deceleration procedure.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain how the accelerate-stop distance is affected by the use of brakes, anti-skid, reverse thrust, ground spoilers (lift dumpers) and by brake energy absorption limits, delayed temperature rise and brake temperature indication.	X							
(07)	X	Explain how the accelerate-stop distance is affected by the use of brakes, anti-skid, reverse thrust, ground spoilers (lift dumpers) and by brake energy absorption limits, delayed temperature rise and brake temperature indication.	X							
032 04 01 04		**Balanced field length concept**								
(01)	X	Define the term 'balanced field length'.	X							
(02)		Describe the relationship between take-off distance and accelerate-stop distance, and identify on a diagram the balanced field length and balanced V_1.	X							
(03)	X	Describe the applicability of a balance field length.	X							
032 04 01 05		**Unbalanced field length concept**								
(01)	X	Describe the applicability of an unbalanced field length.	X							
(02)		Explain the effect of additional stopway on the allowed take-off mass and appropriate V_1 when using an unbalanced field.	X							
(03)		Explain the effect of additional clearway on the allowed take-off mass and appropriate V_1 when using an unbalanced field.	X							
032 04 01 06		**Field-length-limited take-off mass (FLLTOM)**								
(01)		Explain the factors that affect the FLLTOM.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the concept of a 'range of V1' and explain reasons for the placement of the designated V1 towards the faster or slower end of the range.	X							
032 04 01 07		**Contaminated runways**								
(01)		Define a 'contaminated runway', 'wet runway', and a 'dry runway'.	X	X						
(02)		Describe the different types of contamination: wet or water patches, rime- or frost-covered, dry snow, wet snow, slush, ice, compacted or rolled snow, frozen ruts or ridges. ***Source:* ICAO Annex 15, Appendix 2**	X	X						
(03)	X	Identify the difference between friction coefficient and estimated surface friction. ***Source:* ICAO Annex 15, Appendix 2**	X	X						
(04)		State that when friction coefficient is 0.40 or higher, the expected braking action is good. ***Source:* ICAO Annex 14, Vol. I, Attachment A**	X	X						
(05)		Define the different types of hydroplaning. ***Source:* NASA TM-85652, Tire Friction Performance, pp. 6 to 9**	X	X						
(06)		Explain the difference between the two dynamic hydroplaning speeds and state which of them is the most limiting for an aircraft operating on a wet runway. ***Source:* NASA TM-85652, Tire Friction Performance, p. 8**	X	X						
(07)		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						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		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						
(09)		State that the performance associated with contaminated runways is to be found in Part B of the Operations Manual — Performance.	X	X						
032 04 01 08		**Take-off climb**								
(01)		Explain the difference between the flat-rated and non-flat-rated part in performance charts.	X							
(02)		State the differences in climb-gradient requirements for two-, three- and four-engined aeroplanes.	X							
(03)		Explain the effects of aeroplane configuration and meteorological conditions on the take-off climb.	X							
(04)		Determine the climb-limited take-off mass.	X							
032 04 01 09		**Obstacle-limited take-off**								
(01)		Describe the operational regulations for obstacle clearance in the net take-off flight path (NTOFP).	X							
(02)		Define the actual and NTOFP with one-engine-inoperative in accordance with CS-25.	X							
(03)		Explain the effects of aeroplane configuration and meteorological conditions on the obstacle-limited take-off mass.	X							
(04)		Describe the segments of the actual take-off flight path.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe the changes in the configuration, power, thrust and speed in the NTOFP climb segments.	X							
(06)		State the standard maximum bank angle(s) in the first and second segment, and determine the effect on the stall speed and implication on V_2.	X							
(07)		Explain the influence of airspeed selection, acceleration and turns on the climb gradient.	X							
(08)		Describe the European Union airworthiness requirements according to CS-25 relating to aeroplane performance take-off climb and flight path (SUBPART B — FLIGHT PERFORMANCE: CS 25.111, CS 25.115, CS 25.117 and CS 25.121)	X							
032 04 01 10		***Performance-limited take-off mass (PLTOM) and regulated take-off mass (RTOM) tables***								
(01)		Define PLTOM and RTOM.	X							
(02)	X	Describe the use of RTOM tables or similar to find PLTOM and how this can also be done using an EFB.	X							
(03)		Interpret what take-off limitation (field length, obstacle, climb, structural, etc.) is restricting a particular RTOM as it is presented in RTOM tables or similar.	X							
(04)		Describe why data from an EFB can differ from data derived from RTOM tables or similar.	X							
032 04 01 11		**Take-off performance on wet and contaminated runways**								
(01)		Explain the differences between the take-off performance determination on a wet or	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		contaminated runway and on a dry runway.								
(02)		Describe a wet V_1 and explain the consequences of using a wet V_1.	X							
(03)		Describe the hazards, effects and management of operating from a contaminated runway.	X							
(04)		Describe displacement drag, impingement drag, and the methods to monitor acceleration.	X							
(05)		Explain the benefits and implications of using a derated take-off on a contaminated runway.	X							
032 04 01 12		**Use of reduced (flexible or flex) and derated thrust**								
(01)		Explain the advantages and disadvantages of using reduced (flex) and derated thrust.	X							
(02)		Explain the difference between and principles behind reduced (flex) and derated thrust.	X							
(03)		Explain when reduced (flex) and derated thrust may and may not be used.	X							
(04)		Explain the effect of using reduced (flex) and derated thrust on take-off performance including take-off speeds, take-off distance, climb performance and obstacle clearance.	X							
(05)		Explain the assumed temperature method for determining reduced (flex) thrust performance.	X							
032 04 01 13		**Take-off performance using different take-off flap settings**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the advantages and disadvantages of using different take-off flap settings to optimise the performance-limited take-off mass (PLTOM).	X							
(02)		Determine the optimum flap position and PLTOM from given figures.	X							
032 04 01 14		**Take-off performance using increased V_2 speeds ('improved climb performance')**								
(01)		Explain the advantages and disadvantages of the increased V_2 procedure.	X							
(02)		Explain under what circumstances this procedure can be used.	X							
(03)		Explain the hazards of the fast V1 and VLOF speeds associated with the increased V2 procedure and how they can be managed.	X							
032 04 01 15		**Brake-energy and type-speed limit**								
(01)		Explain the effects on take-off performance of brake-energy and tyre-speed limits.	X							
(02)		Explain under what conditions they are more likely to become limiting.	X							
032 04 02 00		**Climb**								
032 04 02 01		**Climb techniques**								
(01)		Explain the effect of climbing at constant IAS on: — TAS; — Mach number; — climb gradient; — rate of climb.	X							
(02)		Explain the effect of climbing at constant Mach number on:	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— TAS; — IAS; — climb gradient; — rate of climb.								
(03)		Explain the correct sequence of climb speeds for turbojet transport aeroplanes.	X							
(04)		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**								
(01)		Explain the effect on the operational speed limit when climbing at constant IAS and at constant Mach number.	X							
(02)		Explain the term ‘crossover altitude’ which occurs during the climb speed schedule (IAS–Mach number).	X							
032 04 03 00		**Cruise**								
032 04 03 01		**Intentionally left blank**								
032 04 03 02		**Intentionally left blank**								
032 04 03 03		**Intentionally left blank**								
032 04 03 04		**Long-range cruise**								
(01)		Define the term ‘long-range cruise’.	X							
(02)		Explain the differences between flying at long-range speed and maximum-range speed with regard to fuel-flow and speed stability.	X							
032 04 03 05		**Intentionally left blank**								
032 04 03 06		**Cruise altitudes**								
(01)	X	Define the term ‘optimum cruise altitude’.	X							
(02)		Explain the differences between flying at long-range speed and maximum-range speed with regard to fuel-flow and speed stability.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the factors that can affect or limit the maximum operating cruise altitude.	X							
(04)		Explain the purpose of, and operational reasons for, a step climb and when such a climb would be initiated for optimum range	X							
(05)		Describe the buffet onset boundary (BOB) and determine the high- and low-speed buffet (speed/Mach number only).	X							
(06)		Analyse the influence of bank angle, mass and the 1.3g buffet margin on a step climb.	X							
(07)		Describe that the high-speed buffet can occur at speeds slower or faster than $M_{MO.}$	X							
(08)		Explain the reasons why a step climb may not be used (e.g. for short sectors, advantageous winds, avoiding turbulence, and due to air traffic restrictions).	X							
032 04 03 07		**Cost index (CI)**								
(01)		Describe 'cost index'.	X							
(02)		Describe the reason for economical cruise speed.	X							
(03)		Describe the effect of cost index on climb, cruise and descent speeds.	X							
032 04 04 00		**En-route one-engine-inoperative**								
032 04 04 01		**Drift-down**								
(01)		Describe the determination of en-route flight-path data with one-engine-inoperative in accordance with CS 25.123.	X							
(02)		Describe the minimum obstacle-clearance height prescribed in the applicable operational requirements.	X							
(03)		Describe the optimum speed that the pilot should select during drift-down.	X							
(04)		Explain the influence of deceleration on the drift-down profiles.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
032 04 04 02		**Influence of variables on the en-route one-engine-inoperative performance**								
(01)		Describe and explain the factors which affect the en-route net drift-down flight path.	X							
032 04 05 00		**Descent**								
032 04 05 01		**Descent techniques**								
(01)		Explain the effect of descending at constant Mach number.	X							
(02)		Explain the effect of descending at constant IAS.	X							
(03)		Explain the correct sequence of descent speeds for turbojet transport aeroplanes.	X							
(04)		Determine the effect on TAS when descending in and above the troposphere at constant Mach number.	X							
(05)		Describe the following limiting speeds for descent: — maximum operating speed (V_{MO}); — maximum Mach number (M_{MO}).	X							
(06)		Explain the effect of a descent at constant Mach number on the margin to low- and high-speed buffet.	X							
032 04 05 02		**Energy management in the descent**								
(01)		Explain the advantages and principle of a continuous descent.	X							
(02)	X	Describe energy management in terms of chemical, potential and kinetic energy.	X							
(03)		Describe the effect of increasing/decreasing headwind and tailwind on profile management.	X							
(04)		Describe the effect of the Mach number to IAS transition (speed conversion) on profile management.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe situations during the descent and approach in which a pilot could find that an aeroplane flies high or fast, and explain how the pilot can manage descent angle/excess energy.	X							
032 04 06 00		**Approach and landing**								
032 04 06 01		**Approach requirements**								
(01)		Describe the CS-25 requirements for the approach climb (CS 25.121).	X							
(02)		Describe the CS-25 requirements for the landing climb.	X							
(03)		Explain the effect of temperature and pressure altitude on approach and landing-climb performance.	X							
032 04 06 02		**Landing-field-length and landing-speed requirements**								
(01)	X	Describe the landing distance determined according to CS 25.125 (‘demonstrated’ landing distance).	X							
(02)		Describe the landing-field-length requirements for dry, wet and contaminated runways and the applicable operational requirements.	X							
(03)	X	Define the ‘landing distance available’ (LDA).	X							
(04)		Define and explain the following speeds in accordance with CS25 or CS-Definitions: — reference stall speed in the landing configuration (VSR0); — reference landing speed (VREF); — minimum control speed, approach and landing (VMCL).	X							
032 04 06 03		**Influence of variables on landing performance**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the effect of runway slope, surface conditions and wind on the maximum landing mass for a given landing distance available in accordance with the applicable operational requirements.	X							
(02)		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							
(03)		Explain the effect of temperature and pressure altitude on the maximum landing mass for a given landing distance available	X							
(04)		Explain the effect of hydroplaning on landing distance required and methods of managing landing on contaminated or wet runways.	X							
032 04 06 04		**Quick turnaround limit**								
(01)		Describe how brake temperature limits the turnarounds times.	X							
032 05 00 00		**CS-25/APPLICABLE OPERATIONAL REQUIREMENTS PERFORMANCE CLASS A — USE OF AEROPLANE PERFORMANCE DATA**	X							
032 05 01 00		**Take-off**								
032 05 01 01		**Take-off (performance data)**								
(01)		Determine from given graphs the field-length-limited take-off mass (FLLTOM) and describe situations in which this limitation could be most restrictive for take-off.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Determine from given graphs the climb-limited take-off mass and describe situations in which this limitation could be most restrictive for take-off.	X							
(03)		Determine from given graphs the obstacle-limited mass and describe situations in which this limitation could be most restrictive for take-off.	X							
(04)		Determine from given graphs the tyre-speed-limited take-off mass.	X							
(05)		Determine from given graphs the maximum brake-energy limited take-off mass.	X							
(06)		Determine the take-off V speeds for the actual take-off mass.	X							
(07)		Determine the maximum take-off mass using given RTOM tables.	X							
(08)		Using RTOM tables, determine the take-off V speeds for the actual take-off weight using appropriate corrections.	X							
(09)		Determine the assumed/flex temperature and take-off V speeds using the RTOM tables.	X							
(10)		Calculate the break cooling time following a rejected take-off given appropriate data.	X							
032 05 02 00		**Drift-down and stabilising altitude**								
032 05 02 01		**Drift-down and stabilising altitude (performance data)**								
(01)		Determine the one-engine-out net stabilising altitude (level-off altitude) from given graphs/tables	X							
(02)		Determine the maximum mass at which the net stabilising altitude with one-engine-out clears the highest relevant								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		obstacle by the required clearance margin.								
(03)		Determine, using drift-down graphs, fuel used, time and distance travelled in a descent from a cruise flight level to a given altitude.	X							
032 05 03 00		**Landing**								
032 05 03 01		**Landing (performance data)**								
(01)		Determine the field length required for landing with a given landing mass from the aeroplane performance data sheets.	X							
(02)		Determine the landing and approach climb-limited landing mass from the aeroplane performance data sheets.	X							
(03)		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							
(04)		Determine the brake cooling time for different landing masses using the aeroplane performance data sheets.	X							

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SUBJECT 033 – FLIGHT PERFORMANCE AND PLANNING AND MONITORING

General Student Pilot Route Manual (GSPRM)

This document shall be referred to as the General Student Pilot Route Manual (GSPRM) and should contain as a minimum: \

1. a table of contents and a list of effective pages;
2. introduction with the instrument flight rules (IFR) charts' legends;
3. 1:500 000 visual flight rule (VFR) aeronautical chart of Germany;
4. en-route low- and high-altitude IFR charts to cover the airspace above all EU Member States plus Norway, Switzerland, Liechtenstein and the Balkans;
5. en-route high-altitude chart of the North Pole (a polar stereographic projection) to illustrate current polar routes;
6. a plotting chart of the North Atlantic (with information on extended range operations with two-engined aeroplanes (ETOPS));
7. area, aerodrome/heliport, aerodrome ground movement, standard instrument departure (SID), standard instrument arrival (STAR) and instrument approach charts (IACs) for Alicante Elche, Amsterdam Schiphol, Dubrovnik Čilipi, London Heathrow, Nantes/Atlantique, Santorini and Stuttgart for aeroplane operations, and Aberdeen, De Kooy and Tromso for helicopter operations;
8. microwave landing system (MLS) approach chart for Galbraith Lake Alaska;
9. an example of a completed air traffic service (ATS) flight plan (with instructions on how to complete it), including the ICAO model flight plan form;
10. introduction with the VFR charts' legends, aerodrome directories for Croatia, France, Germany, Spain and United Kingdom, and area, aerodrome/heliport and visual approach charts (VACs) for Aberdeen Dyce, Alicante Elche, Dubrovnik Čilipi, Friedrichshafen, Gloucestershire and Nantes/Atlantique.

The charts should have a frozen date (e.g. 01.01.2017), and be reissued on a regular basis (e.g. every 4–5 years).

The charts listed above will form the basis for the questions in licensing examinations.

There will be no obligation for any student or approved training organisation (ATO) to buy, use or issue the GSPRM (nor will it have any other subject-matter material in it), but the content will be the basis for charts which may appear in Part-FCL exams. Any chart provider (Lido, Jeppesen, Navtech, etc.) may provide the GSPRM, but the students will not be expected to learn non-ICAO standard symbology or chart requirements.

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Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
030 00 00 00		**FLIGHT PERFORMANCE AND PLANNING**								
033 00 00 00		**FLIGHT PLANNING AND MONITORING**								
033 01 00 00		**FLIGHT PLANNING FOR VFR FLIGHTS** Remark: Using the GSPRM VFR charts.								
033 01 01 00		**VFR navigation plan**								
033 01 01 01		**Airspace, communication, visual and radio-navigation data from VFR charts**								
(01)		Select routes taking the following criteria into account: — classification of airspace; — restricted areas; — VFR semi-circular rules; — visually conspicuous points; — radio-navigation aids.	X	X	X	X	X			
(02)		Find the frequencies or identifiers of radio-navigation aids from charts.	X	X	X	X	X			
(03)		Find the communication frequencies and call signs for the following: — control agencies and service facilities; — flight information service (FIS); — weather information stations; — automatic terminal information service (ATIS).	X	X	X	X	X			
032 01 01 02		**Planning courses, distances and cruising levels with VFR charts**								
(01)		Choose visual waypoints in accordance with specified criteria (large, unique, contrast, vertical extent, etc.).	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Measure courses and distances from a VFR chart.	X	X	X	X	X			
(03)		Find the highest obstacle within a given distance on either side of the course.	X	X	X	X	X			
(04)		Find the following data from a VFR chart and transfer them to a navigation plan: — waypoints or turning points; — distances; — true/magnetic courses.	X	X	X	X	X			
(05)		Calculate the minimum pressure altitude with a given obstacle clearance or true altitude from a given altitude or pressure altitude from minimum grid-area altitude using outside air temperature (OAT) and QNH.	X	X	X	X	X			
(06)		Calculate the vertical or horizontal distance and time to climb or descend to/from a given level or altitude with given data.	X	X	X	X	X			
(07)		Explain how to determine the position of a significant VFR point for insertion into a global navigation satellite system (GNSS) flight plan, using the distance and bearing from an existing significant point and using coordinates.	X	X	X	X	X			
032 01 01 03		**Aerodrome charts and aerodrome directory**								
(01)	X	Explain the reasons for studying the visual departure procedures and the available approach procedures.	X	X	X	X	X			
(02)		Find all visual procedures which can be expected at the departure, destination and alternate aerodromes.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Find all relevant aeronautical and regulatory information required for VFR flight planning from the aerodrome charts or aerodrome directory.	X	X	X	X	X			
032 01 01 04		**Intentionally left blank**								
032 01 01 05		**Completion of navigation plan**								
(01)		Calculate the true airspeed (TAS) from given aircraft performance data, altitude and OAT.	X	X	X	X	X			
(02)		Calculate wind correction angles (WCAs), drift and ground speeds (GS).	X	X	X	X	X			
(03)		Calculate individual and accumulated times for each leg to destination and alternate aerodromes.	X	X	X	X	X			
032 02 00 00		**FLIGHT PLANNING FOR IFR FLIGHTS** Remark: Using the GSPRM IFR charts.								
033 02 01 00		**IFR navigation plan**								
(01)		Identify suitable routings by identifying all relevant aeronautical and regulatory information (including information published in the national aeronautical information publication (AIP)) required for IFR flight planning.	X		X			X	X	
(02)		Identify and describe ATS routes (conventional, area navigation (RNAV), required navigation performance (RNP), conditional routes (CDRs), and direct routes).	X		X			X	X	
033 02 01 02		**Courses and distances from en-route charts**								
(01)		Determine courses and distances.	X		X			X	X	
(02)		Determine bearings and distances of waypoints from radio-navigation aids.	X		X			X	X	
033 02 01 03		**Altitudes**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Define the following altitudes: — minimum en-route altitude (MEA); — minimum obstacle clearance altitude (MOCA); — minimum sector altitude (MSA); — 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	X	
(02)		Extract the following altitudes from the chart(s): — MEA; — MOCA; — MSA; — MORA; — Grid MORA; — MAA; — MCA; — MHA.	X		X			X	X	
(03)		State who is responsible for terrain separation during IFR flight inside and outside controlled airspace.	X		X			X	X	
(04)		State the minimum obstacle clearance requirements for en-route IFR flight inside and outside controlled airspace.	X		X			X	X	
(05)		State when a temperature error correction must be applied by either the pilot or ATC.	X		X			X	X	
(06)		Identify and explain the use of minimum radar vectoring altitudes.	X		X			X	X	
(07)		Calculate the minimum pressure altitude required with a given obstacle clearance, magnetic track, OAT, QNH and reduced	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		vertical separation minimum (RVSM)/non-RVSM information.								
(08)		Calculate true altitude above a given datum using a given pressure altitude, OAT and QNH.	X		X			X	X	
033 02 01 04		**Standard instrument departure (SID) and standard instrument arrival (STAR) routes**								
(01)	X	State the reasons for studying SID and STAR charts.	X		X			X	X	
(02)	X	State that SID and STAR charts show procedures only in a pictorial presentation style which may not be true to scale.	X		X			X	X	
(03)		Interpret all data and information represented on SID and STAR charts, particularly: — routings; — distances; — courses; — radials; — altitudes/levels; — frequencies; — restrictions; — RNAV waypoints and non-RNAV intersection; — fly-over and fly-by waypoints.	X		X			X	X	
(04)		Identify SID and STAR charts which might be relevant for a planned flight.	X		X			X	X	
(05)		Define SID and STAR for RNAV only.	X		X			X	X	
(06)		Describe the difference between SID/STAR, RNAV SID/STAR and RNAV SID/STAR overlay.	X		X			X	X	
033 02 01 05		**Instrument-approach charts**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	State the reasons for being familiar with instrument-approach procedures (IAPs) and appropriate data for departure, destination and alternate aerodromes.	X		X			X	X	
(02)		Select IAPs appropriate for departure, destination and alternate aerodromes.	X		X			X	X	
(03)		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 (DAs/Hs); — (DA/H) and minimum descent altitudes/heights (MDAs/Hs); — visibility and runway visual ranges (RVRs); — approach-light systems.	X		X			X	X	
(04)		Explain the following IAP terms: — type A and B; — 2D and 3D; — CAT I, II and III; — precision approach (conventional and ground-based augmentation system (GBAS)); — non-precision approach (conventional and required navigation performance approach (RNP APCH) (lateral navigation (LNAV),	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		LNAV/vertical navigation (VNAV), localiser performance (LP), localiser performance with vertical guidance (LPV), and required navigation performance authorisation required approach (RNP AR APCH)); — approach procedure with vertical guidance (APV) (APV Baro and APV satellite-based augmentation system (SBAS)).								
033 02 01 06		**Communications and radio-navigation planning data**								
(01)		Find the communication frequencies and call signs for aeronautical services for IFR flights from en-route charts.	X		X			X	X	
(02)		Find the SID and STAR routes to be flown or to be expected.	X		X			X	X	
(03)		Determine the position of top of climb (TOC) and top of descent (TOD) from given appropriate data.	X		X			X	X	
(04)		Determine variation and calculate magnetic/true courses.	X		X			X	X	
(05)		Calculate TAS from given aircraft performance data, altitude and OAT.	X		X			X	X	
(06)		Calculate wind correction angles (WCAs)/drift and ground speeds (GSs).	X		X			X	X	
(07)		Calculate individual and accumulated times for each leg to destination and alternate aerodromes.	X		X			X	X	
(08)		Describe the advantages of global navigation satellite system/flight management computer (GNSS/FMC) equipment regarding:	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— automatic calculation and display of tracks and leg distances; — additional route information in the database (minimum altitudes, approach procedures); — time and fuel estimates over waypoints; — ability to adjust speed to arrive over a waypoint at a defined time; — time and fuel revisions based on predicted and actual wind.								
(09)		Describe the limitations of using GNSS/FMC equipment: — pilot-inputted errors (flight levels, wind, temperature, fuel); — the effect of other than predicted wind on fuel and time estimates; — the effect of aircraft's non-standard configuration on flight management system (FMS) predictions.	X		X			X	X	
033 03 00 00		**FUEL PLANNING — CAT.OP.MPA.106 and CAT.OP.MPA.150 plus AMC1, 2 and 3**								
033 03 01 00		**General**								
033 03 01 01		**Fuel planning (general)**								
(01)		Convert to volume, mass and density given in different units which are commonly used in aviation.	X	X	X	X	X	X	X	
(02)		Determine relevant data, such as fuel capacity, fuel flow/ consumption at different power/thrust settings, altitudes and atmospheric conditions, from the flight manual.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Calculate the attainable flight time/range from given average fuel flow/consumption and available amount of fuel.	X	X	X	X	X	X	X	
(04)		Calculate the required fuel from given average fuel flow/ consumption and required time/range to be flown.	X	X	X	X	X	X	X	
(05)		Calculate the required fuel for a VFR or IFR flight from given forecast meteorological conditions.	X	X	X	X	X	X	X	
(06)		State the minimum amount of remaining fuel required on arrival at the destination and alternate aerodromes/ heliports.	X	X	X	X	X	X	X	
(07)		Explain and describe how to calculate nautical air miles (NAM) from nautical ground miles (NGM).	X	X	X	X	X	X	X	
033 03 02 00		**Pre-flight fuel planning for commercial flights**								
033 03 02 01		**Taxi fuel**								
(01)		Determine the fuel required for engine start and taxiing by consulting the fuel-usage tables or graphs from the flight manual taking into account all the relevant conditions.	X	X	X	X	X			
033 03 02 02		**Trip fuel**								
(01)		Define trip fuel and name the segments of flight for which the trip fuel is relevant.	X	X	X	X	X			
(02)		Determine the trip fuel for the flight by using data from the fuel tables or graphs from the flight manual.	X	X	X	X	X			
033 03 02 03		**Reserve fuel and its components**								
		Contingency fuel								
(01)		Explain the reasons for having contingency fuel.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Calculate the contingency fuel according to the applicable operational requirements.	X	X	X	X	X			
		Alternate fuel								
(03)		Explain the reasons and regulations for having alternate fuel and name the segments of flight for which the alternate fuel is relevant.	X	X	X	X	X			
(04)		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	X	X			
		Final reserve fuel								
(05)		Explain the reasons and regulations for having final reserve fuel.	X	X	X	X	X			
(06)		Calculate the final reserve fuel for an aircraft in accordance with the applicable operational requirements and by using relevant data from the flight manual.	X	X	X	X	X			
		Additional fuel								
(07)		Explain the reasons and regulations for having additional fuel.	X	X	X	X	X			
(08)		Calculate the additional fuel for a flight in accordance with the applicable operational requirements.	X	X	X	X	X			
033 03 02 04		**Extra fuel**								
(01)		Explain the reasons and regulations for having extra fuel in accordance with the applicable operational requirements	X	X	X	X	X			
(02)		Calculate the possible extra fuel under given conditions.	X	X	X	X	X			
(03)		Explain the fuel penalty incurred when loading extra fuel (i.e. the additional fuel consumption due to increased mass).	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
033 03 02 05		**Calculation of total fuel and completion of the fuel section of the navigation plan (fuel plan)**								
(01)		Calculate the total fuel required for a given flight.	X	X	X	X	X			
(02)		Complete the fuel plan.	X	X	X	X	X			
033 03 03 00		**Specific fuel-calculation procedures**								
033 03 03 01		**Reduced contingency fuel procedure**								
(01)	X	Explain the reasons and regulations for reduced contingency fuel as stated in the applicable operational requirements.	X							
(02)		Calculate the contingency fuel and trip fuel required in accordance with the reduced contingency fuel procedure	X							
033 03 03 02		**Isolated aerodrome or heliport procedure**								
(01)	X	Explain the basic procedures for an isolated aerodrome or heliport as stated in the applicable operational requirements.	X		X	X				
(02)		Calculate the additional fuel for aeroplanes or helicopters according to the isolated aerodrome or heliport procedures.	X		X	X				
033 03 03 03		**Predetermined-point procedure**								
(01)	X	Explain the basic idea of the predetermined-point procedure as stated in the applicable operational requirements	X							
033 03 03 04		**Fuel-tankering**								
(01)		Explain the basic idea of fuel-tankering procedures.	X							
(02)		Calculate how much fuel to tank by using given appropriate graphs, tables or data.	X							
033 03 03 05		**Intentionally left blank**								
033 04 00 00		**PRE-FLIGHT PREPARATION**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
033 04 01 00		**Notice to airmen (NOTAM) briefing**								
033 04 01 01		**Ground- and satellite-based facilities and services**								
(01)		Check that the ground- and satellite-based facilities and services required for the planned flight are available and adequate.	X	X	X	X	X	X	X	
033 04 01 02		**Departure, destination and alternate aerodromes**								
(01)		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 WIP; — obstructions; — changes of frequencies for communications, navigation aids and facilities.	X	X	X	X	X	X	X	
(02)		Check that satellite-based facilities are available during the expected time of use.	X	X	X	X	X	X	X	
(03)		Check that GBAS/SBAS augmentation is available during the expected time of use	X	X	X	X	X	X	X	
033 04 01 03		**Airway routings and airspace structure**								
(01)		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	X	
033 04 01 04		**Pre-flight preparation of GNSS achievability**								
(01)		Define why it is important to check GNSS achievability.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Define receiver autonomous integrity monitoring (RAIM), NOTAM and notice advisory to NavStar users (NANU) messages.	X							
(03)		Explain the difference in use of augmented and non-augmented GNSS in connection with the achievability check.	X							
(04)		Explain the difference in planned and unplanned outage of GNSS or SBAS.	X							
033 04 02 00		**Meteorological briefing**								
033 04 02 01		**Intentionally left blank**								
033 04 02 02		**Update of navigation plan using the latest meteorological information**								
(01)		Confirm the most fuel-efficient altitude from given wind, temperature and aircraft data.	X	X					X	
(02)		Confirm true altitudes from given atmospheric data to ensure that statutory minimum clearance is attained.	X	X	X	X	X	X		
(03)		Confirm magnetic headings and GSs.	X	X	X	X	X	X	X	
(04)		Confirm the individual leg times and the total time en-route.	X	X	X	X	X	X	X	
(05)		Confirm the total time en route for the trip to the destination.	X	X	X	X	X	X	X	
(06)		Confirm the total time from destination to the alternate aerodrome.	X	X	X	X	X	X	X	
033 04 02 03		**Intentionally left blank**								
033 04 02 04		**Intentionally left blank**								
033 04 02 05		**Update of fuel plan**								
(01)		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)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Define 'PET'.	X	X	X	X	X			
(02)		Calculate the position of a PET and the estimated time of arrival (ETA) at the PET from given relevant data.	X	X	X	X	X			
033 04 03 02		**Point of safe return (PSR)**								
(01)		Define 'PSR'.	X	X	X	X	X			
(02)		Calculate the position of a PSR and the ETA at the PSR from given relevant data.	X	X	X	X	X			
033 05 00 00		**ICAO FLIGHT PLAN (ATS flight plan (FPL))**								
033 05 01 00		**Individual FPL**								
033 05 01 01		**Format of FPL**								
(01)	X	State the reasons for a fixed format of an ICAO ATS FPL.	X	X	X	X	X	X	X	
(02)		Determine the correct entries to complete an ATS FPL plus decode and interpret the entries in a completed ATS 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	X	
033 05 01 02		**Intentionally left blank**								
033 05 02 00		**Repetitive flight plan (RPL)**								
033 05 02 01		***Repetitive* flight plan (RPL)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Explain the difference between an individual FPL and an RPL.	X		X	X				
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**								
(01)		State the reasons for possible deviations from the planned track and planned timings.	X	X	X	X	X	X		
(02)		Calculate GS by using actual in-flight parameters.	X	X	X	X	X	X		
(03)		Calculate the expected leg times by using actual in-flight parameters.	X	X	X	X	X	X		
(04)		Enter, in the progress of flight, at the checkpoint or turning point, the 'actual time-over' and the 'estimated time-over' for the next checkpoint into the flight plan.	X	X	X	X	X			
(05)		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			
(06)		Calculate revised ETA based on changes to the pre-flight plan, including changes of W/V, cruise level, OAT, distances, Mach number and calibrated airspeed (CAS).	X	X	X	X	X			
033 06 01 02		**In-flight fuel management**								
(01)		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		
(02)		Assess deviations of actual fuel consumption from planned consumption.	X	X	X	X	X	X		
(03)		Calculate fuel quantity used, fuel consumption, and fuel remaining at navigation checkpoints/waypoints.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Compare the actual with the planned fuel consumption by means of calculation.	X	X	X	X	X	X		
(05)		Determine the remaining range and endurance by means of calculation.	X	X	X	X	X	X		
(06)		Calculate the revised fuel consumption based on changes to the pre-flight plan, including changes of W/V, cruise level, OAT, distances, Mach number and CAS.	X	X	X	X	X	X		
033 06 02 00		**In-flight replanning**								
033 06 02 01		**Deviation from planned data**								
(01)		State that the commander is responsible for ensuring that, even in case of diversion, the remaining fuel is not less than the fuel required to proceed to an aerodrome where a safe landing can be made, with final reserve fuel remaining.	X	X	X	X	X			
(02)		Explain that, in the case of an in-flight update, the commander has to check the following: — the suitability of the new destination or alternate aerodrome; — meteorological conditions on revised routing and at revised destination or alternate aerodrome; — the aircraft must be able to land with the prescribed final reserve fuel.	X	X	X	X	X			
(03)		Calculate the revised destination/alternate aerodrome landing mass from given latest data.	X	X	X	X	X			

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SUBJECT 034 – FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – HELICOPTERS

Note that the term ‘mass’ is used to describe a quantity of matter, and ‘weight’ when describing the force. However, the term ‘weight’ is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term ‘weight’ is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
030 00 00 00		**FLIGHT PERFORMANCE AND PLANNING**								
034 00 00 00		**PERFORMANCE – HELICOPTERS**								
034 01 00 00		**GENERAL**								
034 01 01 00		**Performance legislation**								
034 01 01 01		**Airworthiness requirements**								
(01)		Interpret the airworthiness requirements of CS-27 and CS-29.			X	X	X			
(02)		Name the general differences between helicopters certified according to CS-27 and CS-29.			X	X	X			
034 01 01 02		**Operational regulations**								
(01)		State that the person responsible for complying with operational procedures is the commander.			X	X	X			
(02)		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				
(03)		Interpret the charts showing minimum clearances associated with CAT A and CAT B procedures.			X	X				
034 01 02 00		**General performance theory**								
034 01 02 01		**Phases of flight**								
(01)		Explain the following phases of flight:			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— take-off; — climb; — level flight; — descent; — approach and landing.								
(02)		Describe the necessity for different take-off and landing procedures.			X	X	X			
034 01 02 02		**Definitions and terms**								
(01)		Define the following terms: — CAT A; — CAT B; — Performance Class 1, 2 and 3; — congested area; — elevated heliport; — helideck; — heliport; — hostile environment; — maximum operational passenger seating configuration (MOPSC); — 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			
(02)		Define the following terms: — reported headwind component; — take-off decision point (TDP);			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— defined point after take-off (DPATO); — take-off distance required helicopter (TODRH); — take-off distance available helicopter (TODAH); — distance required (DR); — rejected take-off distance required helicopter (RTODRH); — rotation point (RP); — committal point (CP); — defined point before landing (DPBL); — landing decision point (LDP); — landing distance available helicopter (LDAH); — landing distance required helicopter (LDRH); — ditching (see operations).								
(03)		Understand the meaning and significance of the acronyms AEO and OEI.			X	X				
(04)		Define the terms ‘climb angle’ and ‘climb gradient’.			X	X				
(05)		Define the terms ‘flight-path angle’ and ‘flight-path gradient’.			X	X				
(06)		Define ‘VmaxRange’ (speed for maximum range) and VmaxEnd (speed for maximum endurance).			X	X	X			
(07)		Define and calculate the gradient by using power, wind, and helicopter mass.			X	X				
(08)		Explain the terms ‘operational ceiling’ and ‘absolute ceiling’.			X	X	X			
(09)		Explain the term ‘service ceiling OEI’.			X	X	X			
(10)		Explain the difference between hovering in ground effect (HIGE) and hovering out of ground effect (HOGE).			X	X	X			

UNCONTROLLED

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
034 01 02 03		**Power required/power available curves**								
(01)		Understand and interpret the power required/power available versus TAS graphs.			X	X	X			
034 01 02 04		**Height-velocity graphs**								
(01)		Understand and interpret height-velocity graphs.			X	X	X			
034 01 02 05		**Influencing variables on performance**								
(01)		Explain how the following factors affect helicopter performance: — pressure altitude; — humidity; — temperature; — wind; — helicopter mass; — helicopter configuration; — helicopter centre of gravity (CG).			X	X	X			
034 02 00 00		**PERFORMANCE CLASS 3 – SINGLE-ENGINE HELICOPTERS**								
034 02 01 00		**Effect of variable on single-engine (SE) helicopter performance**								
034 02 01 01		**Effect of variables on SE helicopter performance**								
(01)		Determine the wind component, altitude and temperature for hovering, take-off and landing.			X	X	X			
(02)		Explain that operations are to be conducted 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 (point CAT.OP.MPA.137 of the EU Regulation on air operations, except when the helicopter is approved to operate in			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		accordance with point CAT.POL.H.420). (Consider the exception: Operations may be conducted in a hostile environment. Ground level exposure — and exposure for elevated final approach and take-off areas (FATOs) or helidecks in non-hostile environments — is allowed for operations approved under CAT.POL.H.305, during the take-off and landing phases.)								
(03)		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**								
034 02 02 01		**Take-off and landing (including hover)**								
(01)		Explain the take-off and landing requirements.			X	X	X			
(02)		Explain the maximum allowed take-off and landing mass.			X	X	X			
(03)		Explain that mass has to be restricted to HIGE.			X	X	X			
(04)		Explain that if HIGE is unlikely to be achieved (for example, blocked by an obstruction), then mass must be restricted to HOGE.			X	X	X			
034 02 03 00		**Climb, cruise and descent**								
034 02 03 01		**Climb, cruise and descent (capabilities)**								
(01)		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			
(02)		Explain the effect of altitude on the maximum endurance speed.			X	X	X			
034 02 04 00		**Use of helicopter performance data**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
034 02 04 01		**Take-off (including hover)**								
(01)		Find the maximum wind component.			X	X	X			
(02)		Find the maximum allowed take-off mass for certain conditions.			X	X	X			
(03)		Find the height-velocity parameters.			X	X	X			
034 02 04 02		**Climb**								
(01)		Find the time, distance and fuel required to climb for certain conditions.			X	X	X			
(02)		Find the rate of climb under given conditions and the best rate-of-climb speed V_y.			X	X	X			
034 02 04 03		**Cruise**								
(01)		Find the cruising speed and fuel consumption for certain conditions.			X	X	X			
(02)		Calculate the range and endurance under given conditions.			X	X	X			
034 02 04 04		**Landing (including hover)**								
(01)		Find the maximum wind component.			X	X	X			
(02)		Find the maximum allowed landing mass for certain conditions.			X	X	X			
(03)		Find the height-velocity parameters.			X	X	X			
034 03 00 00		**PERFORMANCE CLASS 2**								
		General remark: The Learning Objectives for Performance Class 2 are principally identical with those for Performance Class 1. (See 034 04 00 00) Additional Learning Objectives are shown below								
034 03 01 00		**Operations without an assured safe forced landing capability**								
034 03 01 01		**Responsibility for operations without an assured safe forced landing capability**								

EASA ENDORSED

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the responsibility of the operator for assuring safe forced landings (point CAT.POL.H.305 of the EU Regulation on air operations).			X	X				
034 03 02 00		**Take-off**								
034 03 02 01		**Take-off requirements**								
(01)		State the climb and other requirements for take-off.			X	X				
034 03 03 00		**Take-off flight path**								
034 03 03 01		**Take-off flight path requirements**								
(01)		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**								
034 03 04 01		**Landing requirements**								
(01)		State the requirements for the climb capability when OEI.			X	X				
(02)		State the options for a Performance Class 2 operation in the case of a critical power-unit failure at any point in the approach path.			X	X				
(03)		State the limitations for operations to/from a helideck.			X	X				
034 04 00 00		**PERFORMANCE CLASS 1 – HELICOPTERS CERTIFIED**								
034 04 01 00		**Take-off**								
034 04 01 01		**Take-off distances**								
(01)		Explain the effects of the following variables on the flight-path and take-off distances: — take-off with HIGE or HOGE; — take-off procedure;			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— obstacle clearances both laterally and vertically; — take-off from non-elevated heliports; — take-off from elevated heliports or helidecks; — take-off from a TLOF.								
(02)		Explain the effects of the following variables on take-off distances: — mass; — take-off configuration; — bleed-air configurations.			X	X				
(03)		Explain the effects of the following meteorological conditions on take-off distances: — wind; — temperature; — pressure altitude.			X	X				
(04)		Explain the take-off distances for specified conditions and configuration for AEO and OEI.			X	X				
(05)		Explain the effect of obstacles on the take-off distance required.			X	X				
(06)		State the assumed reaction time between engine failure and recognition.			X	X				
(07)		Explain that the flight must be carried out visually up to TDP			X	X				
034 04 01 02		**Rejected take-off distance required (helicopter) (RTODR(h))**								
(01)		Explain RTODR(H) for specified conditions and configuration for AEO and OEI.			X	X				
(02)		Explain the time-to-decide allowance (decision time) and deceleration procedure.			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
034 04 01 03		**Intentionally left blank**								
034 04 01 04		**Take-off climb**								
(01)		Define the segments of the take-off flight path.			X	X				
(02)		Explain the effect of changes in the configuration on power and speed in the segments.			X	X				
(03)		Explain the climb-gradient requirements for OEI.			X	X				
(04)		State the minimum altitude over the take-off path when flying at the take-off safety speed in a Category A helicopter (V_{TOSS}).			X	X				
(05)		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**								
(01)		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 performance**								
(01)		Determine from helicopter performance data sheets the maximum mass that satisfies the operational regulations for take-off in terms of regulated take-off mass, TODRH and minimum gradients for climb and obstacle clearance.			X	X				
034 04 02 00		**Climb**								
034 04 02 01		**Climb techniques**								
(01)		Explain the effect of climbing with best rate-of-climb speed (V_Y).			X	X				
(02)		Explain the influence of altitude on V_Y.			X	X				
034 04 02 02		**Use of helicopter flight data**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		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**								
(01)		Explain the cruise procedures for 'maximum endurance' and 'maximum range'.			X	X				
034 04 03 02		**Maximum endurance**								
(01)		Explain fuel flow in relation to the true airspeed (TAS)			X	X				
(02)		Explain the speed for the maximum endurance.			X	X				
034 04 03 03		**Maximum range**								
(01)		Explain the speed for the maximum range.			X	X				
034 04 03 04		**Maximum cruise**								
(01)		Explain the speed for maximum cruise.			X	X				
034 04 03 05		**Cruise altitudes**								
(01)		Explain the factors which might affect or limit the operating altitude.			X	X				
(02)		Understand the relation between power setting, fuel consumption, cruising speed and altitude.			X	X				
034 04 03 06		**Use of helicopter performance data**								
(01)		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 (OEI)**								
034 04 04 01		**Requirements for en-route flights with OEI**								
(01)		State the flight-path clearance requirements.			X	X				
(02)		Explain drift-down techniques.			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State the reduction in the flight-path width when navigational accuracy can be achieved.			X	X				
034 04 04 02		**Use of helicopter data**								
(01)		Find the single-engine service ceiling, range and endurance from given engine-inoperative charts.			X	X				
(02)		Find OEI operating data from suitable charts.			X	X				
(03)		Find the amount of fuel to be jettisoned in order to reduce helicopter mass.			X	X				
(04)		Calculate the relevant parameters for drift-down procedures.			X	X				
034 04 05 00		**Descent**								
034 04 05 01		**Use of helicopter flight data**								
(01)		Find the rate of descent and calculate the time to descend to a given altitude.			X	X				
034 04 06 00		**Landing**								
034 04 06 01		**Landing requirements**								
(01)		State the requirements for landing.			X	X				
034 04 06 02		**Landing procedures**								
(01)		Explain the procedure for critical power-unit failure before and after the landing decision point			X	X				
(02)		Explain that the portion of flight after the landing decision point must be carried out visually.			X	X				
(03)		Explain the procedures and required obstacle clearances for landings on different heliports/helidecks.			X	X				
034 04 06 03		**Use of helicopter performance data**								
(01)		Determine from helicopter performance data sheets the maximum mass that satisfies the operational regulations for			X	X				

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		landing in terms of regulated landing mass, LDRH and minimum gradients for climb and obstacle clearance.								

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SUBJECT 040 – HUMAN PERFORMANCE AND LIMITATIONS

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
040 00 00 00		**HUMAN PERFORMANCE AND LIMITATIONS**								
040 01 00 00		**HUMAN FACTORS: BASIC CONCEPTS**								
040 01 01 00		**Human factors in aviation**								
040 01 01 01		**Becoming a competent pilot**								
(01)		State that competence is based on knowledge, skills and attitudes of the individual pilot, and list the ICAO eight core competencies: — application of procedures; — communication; — aircraft flight path management, automation; — aircraft flight path management, manual control; — leadership and teamwork; — problem-solving and decision-making; — situation awareness; — workload management.	X	X	X	X	X	X		
040 01 02 00		**Intentionally left blank**								
040 01 03 00		**Flight safety concepts**								
040 01 03 01		**Threat and error management (TEM) model and SHELL model**								
(01)		Explain the three components of the TEM model.	X	X	X	X	X	X	X	
(02)		Explain and give examples of latent threats	X	X	X	X	X	X	X	
(03)		Explain and give examples of environmental threats.	X	X	X	X	X	X	X	
(04)		Explain and give examples of organisational threats.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Explain and give a definition of 'error' according to the TEM model of ICAO Doc 9683 (Part II, Chapter 2).	X	X	X	X	X	X	X	
(06)		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	X	
(07)		Explain and give examples of procedural error, communication errors, and aircraft handling errors.	X	X	X	X	X	X	X	
(08)		Explain and give examples of 'undesired aircraft states'.	X	X	X	X	X	X		
(09)		State the components of the SHELL model.	X	X	X	X	X	X		
(10)		State the relevance of the SHELL model to the work in the cockpit.								
040 01 04 00		**Safety culture**								
040 01 04 01		**Safety culture and safety management**								
(01)		Distinguish between 'open cultures' and 'closed cultures'.	X	X	X	X	X	X	X	
(02)		Illustrate how safety culture is reflected in national culture.	X	X	X	X	X	X	X	
(03)		Discuss the established expression 'safety first' in a commercial entity.	X	X	X	X	X	X		
(04)		Explain James Reasons' 'Swiss Cheese Model'.	X	X	X	X	X	X	X	
(05)		State the important factors that promote a good safety culture.	X	X	X	X	X	X	X	
(06)		Distinguish between 'just culture' and 'non-punitive culture'.	X	X	X	X	X	X	X	
(07)		Name the five components which form safety culture (according to James Reason: informed culture, reporting	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		culture, learning culture, just culture, flexible culture).								
(08)		Name the basic concepts of safety management system (SMS) (including hazard identification and risk management) and its relationship with safety culture in order to: — define how the organisation is set up to manage risks; — identify workplace risk and implement suitable controls; — implement effective communication across all levels of the organisation.	X	X	X	X	X	X	X	
040 02 00 00		**Basics of aviation physiology and health maintenance**								
040 02 01 00		**Basics of flight physiology**								
040 02 01 01		**The atmosphere**								
(01)		State that the volume percentage of the gases in ambient air will remain constant at all altitudes at which conventional aircraft operate.	X	X	X	X	X	X		
040 02 01 02		**Respiratory and circulatory system**								
(01)		List the main components of the respiratory system and their function.	X	X	X	X	X	X		
(02)		Identify the different volumes of air in the lungs and state the normal respiratory rate.	X	X	X	X	X	X		
(03)		Explain the role of carbon dioxide in the control and regulation of respiration.	X	X	X	X	X	X		
(04)		Describe the basic processes of external respiration and internal respiration.	X	X	X	X	X	X		
(05)		List the factors that determine pulse rate.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Name the major components of the circulatory system and describe their function.	X	X	X	X	X	X		
(07)		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		
(08)		Define 'systolic' and 'diastolic' blood pressure.	X	X	X	X	X	X		
(09)		State the normal blood pressure ranges and units of measurement.	X	X	X	X	X	X		
(10)		List the main constituents of blood and describe their functions.	X	X	X	X	X	X		
(11)		Stress the function of haemoglobin in the circulatory system.	X	X	X	X	X	X		
(12)		Define 'anaemia' and state its common causes.	X	X	X	X	X	X		
(13)		Indicate the effect of increasing altitude on haemoglobin oxygen saturation.	X	X	X	X	X	X		
		Hypertension and hypotension								
(14)		Define 'hypertension' and 'hypotension'.	X	X	X	X	X	X		
(15)		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		
(16)		State that both hypotension and hypertension may disqualify a pilot from obtaining medical clearance to fly.	X	X	X	X	X	X		
(17)		List the factors which can lead to hypertension for an individual.	X	X	X	X	X	X		
(18)		State the corrective actions that may be taken to reduce high blood pressure.	X	X	X	X	X	X		
(19)		Stress that hypertension is the major factor of strokes in the general population.	X	X	X	X	X	X		
		Coronary artery disease								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(20)		Differentiate between ‘angina’ and ‘heart attack’.	X	X	X	X	X	X		
(21)		Explain the major risk factors for coronary disease.	X	X	X	X	X	X		
(22)		State the role physical exercise plays in reducing the chances of developing coronary disease.	X	X	X	X	X	X		
		Hypoxia								
(23)		Define the two major forms of hypoxia (hypoxic and anaemic), and the common causes of both.	X	X	X	X	X	X		
(24)		State the symptoms of hypoxia.	X	X	X	X	X	X		
(25)		State that healthy people are able to compensate for altitudes up to approximately 10 000–12 000 ft.	X	X	X	X	X	X		
(26)		Name the three physiological thresholds and allocate the corresponding altitudes for each of them: — reaction threshold (7 000 ft); — disturbance threshold (10–12 000 ft); and — critical threshold (22 000 ft).	X	X	X	X	X	X		
(27)		State the altitude at which short-term memory begins to be affected by hypoxia.	X	X	X	X	X	X		
(28)		Define the terms ‘time of useful consciousness’ (TUC) and ‘effective performance time’ (EPT).	X	X	X	X	X	X		
(29)		State that TUC varies among individuals, but the approximate values for a person seated (at rest) are: 20 000 ft 30 min 30 000 ft 1–2 min 35 000 ft 30–90 s 40 000 ft 15–20 s	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(30)		List the factors that determine the severity of hypoxia.	X	X	X	X	X	X		
(31)		State the equivalent altitudes when breathing ambient air and 100 % oxygen at mean sea level (MSL) and at approximately 10 000, 30 000 and 40 000 ft.	X	X	X	X	X	X		
		Hyperventilation								
(32)		Describe the role of carbon dioxide in hyperventilation.	X	X	X	X	X	X		
(33)		Define the term 'hyperventilation'.	X	X	X	X	X	X		
(34)		List the factors that cause hyperventilation.	X	X	X	X	X	X		
(35)		State that hyperventilation may be caused by psychological or physiological reasons.	X	X	X	X	X	X		
(36)		List the signs and symptoms of hyperventilation.	X	X	X	X	X	X		
(37)		List the measures which may be taken to counteract hyperventilation: breath slowly, close one opening of the nose, speak loudly, place a paper bag over nose and mouth.	X	X	X	X	X	X		
		Decompression sickness/illness								
(38)		State the normal range of cabin pressure altitude in pressurised commercial air transport aircraft and describe its protective function for aircrew and passengers.	X	X	X	X	X	X		
(39)		List the vital actions the crew has to perform when cabin pressurisation is lost (oxygen mask on, emergency descent, land as soon as possible, and no further flight for the next minimum 24 hours). State that decompression sickness symptoms can occur up to 24 hours later.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(40)		Identify the causes of decompression sickness in flight operation.	X	X	X	X	X	X		
(41)		State how decompression sickness can be prevented.	X	X	X	X	X	X		
(42)		List the symptoms of decompression sickness (bends, creeps, chokes, staggers).	X	X	X	X	X	X		
(43)		Indicate how decompression sickness may be treated.	X	X	X	X	X	X		
(44)		Define the hazards of diving and flying, and give the recommendations associated with these activities.	X	X	X	X	X	X		
		Acceleration								
(45)		Define 'linear acceleration' and 'angular acceleration'.	X	X	X	X	X	X	X	
(46)		Describe the effects of z-acceleration on the circulation and blood volume distribution.	X	X	X	X	X	X		
(47)		List magnitude, duration and onset as factors that determine the effects of acceleration on the human body.	X	X	X	X	X	X	X	
(48)		List the effects of positive acceleration with respect to type, sequence and corresponding G-load.	X	X	X	X	X	X		
		Carbon monoxide								
(49)		State how carbon monoxide is produced.	X	X	X	X	X	X		
(50)		State how the presence of carbon monoxide in the blood affects the distribution of oxygen.	X	X	X	X	X	X		
(51)		List the signs and symptoms of carbon-monoxide poisoning.	X	X	X	X	X	X		
(52)		Explain immediate countermeasures on suspicion of carbon monoxide poisoning	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		and how poisoning can be treated later on the ground.								
040 02 01 03		**High-altitude environment**								
(01)		State how an increase in altitude may change the proportion of ozone in the atmosphere and that aircraft can be equipped with special ozone removers.	X							
		Radiation								
(02)		State the sources of radiation at high altitude.	X							
(03)		List the effects of excessive exposure to radiation.	X							
		Humidity								
(04)		List the factors that affect the relative humidity of both the atmosphere and cabin air.	X							
(05)		List the effects of low humidity on human body to be spurious thirst, dry eyes, skin and mucous membranes, and indicate measures that can be taken: drinking water, using eye drops and aqueous creams.	X							
040 02 02 00		**People and the environment: the sensory system**								
040 02 02 01		**The different senses**								
(01)		List the different senses	X	X	X	X	X	X	X	
040 02 02 02		**Central, peripheral and automatic nervous system**								
(01)		Define the term ‘sensory threshold’.	X	X	X	X	X	X		
(02)		Define the term ‘sensitivity’, especially in the context of vision.	X	X	X	X	X	X		
(03)		Give examples of sensory adaptation.	X	X	X	X	X	X		
(04)		Define the term ‘habituation’ and state its implication for flight safety.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
040 02 02 03		**Vision**								
		Functional anatomy								
(01)		Name the most important parts of the eye and the pathway to the visual cortex.	X	X	X	X	X	X		
(02)		State the basic functions of the parts of the eye.	X	X	X	X	X	X		
(03)		Define 'accommodation'.	X	X	X	X	X	X		
(04)		Distinguish between the functions of the rod and cone cells.	X	X	X	X	X	X		
(05)		Describe the distribution of rod and cone cells in the retina and explain their relevance to vision.	X	X	X	X	X	X		
		The fovea (fovea centralis) and peripheral vision								
(06)		Explain the terms 'visual acuity', 'visual field', 'central vision', 'peripheral vision' and 'the fovea', and explain their function in the process of vision.	X	X	X	X	X	X		
(07)		List the factors that may degrade visual acuity and the importance of 'lookout'.	X	X	X	X	X	X		
(08)		State the limitations of night vision and the different scanning techniques at both night and day.	X	X	X	X	X	X		
(09)		State the time necessary for the eye to adapt both to bright light and the dark.	X	X	X	X	X	X		
(10)		State the effect of hypoxia, smoking and altitude in excess of 5 000 ft on night vision.	X	X	X	X	X	X		
(11)		Explain the nature of colour blindness.	X	X	X	X	X	X		
		Binocular and monocular vision								
(12)		Distinguish between monocular and binocular vision.	X	X	X	X	X	X		
(13)		Explain the basis of depth perception and its relevance to flight performance.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(14)		List the possible monocular cues for depth perception.	X	X	X	X	X	X		
(15)		State that for high-energy blue light and UV rays, sunglasses can prevent damage to the retina.	X	X	X	X	X	X		
		Defective vision								
(16)		Explain long-sightedness, short-sightedness and astigmatism.	X	X	X	X	X	X		
(17)		List the causes of and the precautions that may be taken to reduce the probability of vision loss due to: — presbyopia; — cataract; — glaucoma.	X	X	X	X	X	X		
(18)		List the types of sunglasses that could cause perceptional problems in flight.	X	X	X	X	X	X		
(19)		List the measures that may be taken to protect oneself from flash blindness.	X	X	X	X	X	X		
(20)		State the possible problems associated with contact lenses.	X	X	X	X	X	X		
(21)		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		
(22)		Explain the significance of the ‘blind spot’ on the retina in detecting other traffic in flight.	X	X	X	X	X	X		
040 02 02 04		**Hearing**								
		Descriptive and functional anatomy								
(01)		State the basic parts and functions of the outer, the middle and the inner ear.	X	X	X	X	X	X		
(02)		Differentiate between the functions of the vestibular apparatus and the cochlea in the inner ear.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Hearing lost								
(03)		Define the main causes of the following hearing defects/loss: — 'conductive deafness'; — 'noise-induced hearing loss' (NIHL); — 'presbycusis'.	X	X	X	X	X	X		
(04)		Summarise the effects of environmental noise on hearing.	X	X	X	X	X	X		
(05)		State the decibel level of received noise that will cause NIHL.	X	X	X	X	X	X		
(06)		Identify the potential occupational risks that may cause hearing loss.	X	X	X	X	X	X		
(07)		List the main sources of hearing loss in the flying environment.	X	X	X	X	X	X		
(08)		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 05		**Equilibrium**								
		Functional anatomy								
(01)		List the main elements of the vestibular apparatus.	X	X	X	X	X	X		
(02)		State the functions of the vestibular apparatus on the ground and in flight.	X	X	X	X	X	X		
(03)		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		
(04)		Explain how the semi-circular canals are stimulated.	X	X	X	X	X	X		
		Motion sickness								
(05)		Describe air sickness and its accompanying symptoms.	X	X	X	X	X	X	X	
(06)		List the causes of air sickness.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Describe the necessary actions to be taken to counteract the symptoms of air sickness.	X	X	X	X	X	X		
040 02 02 06		**Integration of sensory inputs**								
(01)		State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight.	X	X	X	X	X	X	X	
(02)		Define the term 'illusion'.	X	X	X	X	X	X	X	
(03)		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, field myopia, and surface planes.	X	X	X	X	X	X	X	
(04)		Relate these illusions to problems that may be experienced in flight and identify the danger attached to them.	X	X	X	X	X	X	X	
(05)		List approach and landing illusions for slope of the runway, black-hole approach, and terrain around runway, and state the danger involved with recommendations to avoid or counteract the problems with high or low approach or flare at the wrong time.	X	X	X	X	X	X	X	
(06)		State the problems associated with flickering lights (strobe lights, anti-collision lights, propellers and rotors under certain light conditions, etc.).	X	X	X	X	X	X	X	
(07)		Describe vestibular illusions caused by the angular accelerations (the Leans, Coriolis) and linear accelerations (somatogravic, G-effect).	X	X	X	X	X	X	X	
(08)		Relate the above-mentioned vestibular illusions to problems encountered in flight and state the dangers involved.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		State that the 'seat-of-the-pants' sense is completely unreliable when visual contact with the ground is lost or when flying in instrument meteorological conditions (IMC) or with a poor visual horizon.	X	X	X	X	X	X	X	
(10)		Differentiate between vertigo, Coriolis effect, and spatial disorientation.	X	X	X	X	X	X	X	
(11)		List the measures to prevent or overcome spatial disorientation.	X	X	X	X	X	X	X	
040 02 03 00		**Health and hygiene**								
040 02 03 01		**Intentionally left blank**								
040 02 03 02		**Body rhythm and sleep**								
(01)		Name some internal body rhythms and their relevance to sleep. Explain that the most important of which is body temperature.	X	X	X	X				
(02)		Explain the term 'circadian rhythm'.	X	X	X	X	X			
(03)		State the approximate duration of a 'free-running' rhythm.	X	X	X	X	X			
(04)		Explain the significance of the 'internal clock' in regulating the normal circadian rhythm.	X	X	X	X	X			
(05)		State the effect of the circadian rhythm of body temperature on an individual's performance standard and on an individual's sleep patterns.	X	X	X	X	X			
(06)		List and describe the stages of a sleep cycle.	X	X	X	X	X			
(07)		Differentiate between rapid eye movement (REM) and non-REM sleep.	X	X	X	X	X			
(08)		Explain the function of sleep and describe the effects of insufficient sleep on performance.	X	X	X	X	X			

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		Explain the simple calculations for the sleep/wake credit/debit situation.	X	X	X	X	X			
(10)		Explain how sleep debit can become cumulative.	X	X	X	X	X			
(11)		State the time formula for the adjustment of body rhythms to the new local time scale after crossing time zones.	X	X	X	X	X			
(12)		State the problems caused by circadian dysrhythmia (jet lag) with regard to an individual's performance and sleep.	X	X	X	X	X			
(13)		Differentiate between the effects of westbound and eastbound travel.	X	X	X	X	X			
(14)		Explain the interactive effects of circadian rhythm and vigilance on a pilot's performance during flight as the duty day elapses.	X	X	X	X	X			
(15)		Describe the main effects of lack of sleep on an individual's performance.	X	X	X	X	X			
(16)		List the possible strategies to cope with jet lag.								
040 02 03 03		**Problem areas for pilots**								
		Common minor ailments								
(01)		State the role of the Eustachian tube in equalising pressure between the middle ear and the environment.	X	X	X	X	X	X		
(02)		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		
(03)		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		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		State when a pilot should seek medical advice from an aeromedical examiner (AME) or aeromedical centre (AeMC).	X	X	X	X	X	X		
(05)		Describe the measures to prevent or clear problems due to pressure changes during flight.	X	X	X	X	X	X		
		Entrapped gases and barotrauma								
(06)		Define 'barotrauma'.	X	X	X	X	X	X		
(07)		Differentiate between otic, sinus, gastrointestinal and aerodontalgia (of the teeth) barotraumas and explain avoidance strategies.	X	X	X	X	X	X		
(08)		Explain why the effects of otic barotrauma can be worse in the descent.	X	X	X	X	X	X		
		Gastrointestinal upsets								
(09)		State the effects of gastrointestinal upsets that may occur during flight.	X	X	X	X	X	X		
(10)		List the precautions that should be observed to reduce the occurrence of gastrointestinal upsets.	X	X	X	X	X	X		
(11)		Indicate the major sources of gastrointestinal upsets.	X	X	X	X	X	X		
		Obesity								
(12)		Define 'obesity'.	X	X	X	X	X	X		
(13)		State the following harmful effects obesity can cause: — possibility of developing coronary problems; — increased chances of developing diabetes; — reduced ability to withstand G-forces; — development of problems with the joints of the limbs; — general circulatory problems;	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— reduced ability to cope with hypoxia or decompression sickness; — sleep apnoea.								
(14)		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		
(15)		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								
(16)		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		
(17)		List the major contaminating sources in foodstuffs.	X	X	X	X	X	X		
(18)		State the major constituents of a healthy diet.	X	X	X	X	X	X		
(19)		State the measure to avoid hypoglycaemia.	X	X	X	X	X	X		
(20)		State the importance of adequate hydration.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Tropical climates								
(21)		List the problems associated with operating in tropical climates.	X	X	X	X	X			
(22)		State the possible causes/sources of incapacitation in tropical countries with reference to: — standards of hygiene; — quality of water supply; — insect borne diseases; — parasitic worms; — rabies or other diseases that may be spread through contact with animals; — sexually transmitted diseases.	X	X	X	X	X			
(23)		State the precautions to be taken to reduce the risks of developing problems in tropical areas.	X	X	X	X	X			
		Infectious diseases								
(24)		State the major infectious diseases that may severely incapacitate or kill individuals.	X	X	X	X	X	X		
(25)		State the precautions that 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								
(01)		State the harmful effects of tobacco on: — the respiratory system; — the cardiovascular system; — the ability to resist hypoxia; — the ability to withstand G-forces; — night vision.	X	X	X	X	X	X		
		Caffeine								
(02)		Indicate the level of caffeine dosage at which performance is degraded.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Besides coffee, indicate other beverages containing caffeine.	X	X	X	X	X	X		
		Alcohol								
(04)		State the maximum acceptable limit of alcohol for flight crew according to the applicable regulations.	X	X	X	X	X	X		
(05)		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		
(06)		State the effects alcohol may have if consumed together with other drugs.	X	X	X	X	X	X		
(07)		List the signs and symptoms of alcoholism.	X	X	X	X	X	X		
(08)		List the factors that may be associated with the development of alcoholism.	X	X	X	X	X	X		
(09)		Define the ‘unit’ of alcohol and state the approximate elimination rate from the blood.	X	X	X	X	X	X		
(10)		State the maximum daily and weekly intake of units of alcohol which may be consumed without causing damage to the organs and systems of the human body.	X	X	X	X	X	X		
(11)		Discuss the actions that might be taken if a crew member is suspected of being an alcoholic.	X		X	X				
		Prescription and non-prescription drugs and self-medication								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(12)		State the dangers associated with the use of non-prescription drugs.	X	X	X	X	X	X		
(13)		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		
(14)		Interpret the rules relevant to using (prescription or non-prescription) drugs that the pilot has not used before.	X	X	X	X	X	X		
(15)		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								
(16)		List those materials present in an aircraft which may, when uncontained, cause severe health problems.	X	X	X	X	X	X		
(17)		List those aircraft-component parts which if burnt may give off toxic fumes.	X	X	X	X	X	X		
(18)		Describe a fume event and the possible incapacitating effects on those exposed to it.	X	X	X	X	X	X		
040 02 03 05		**Incapacitation in flight**								
(01)		State that incapacitation is most dangerous when its onset is insidious.	X	X	X	X	X	X		
(02)		List the major causes of in-flight incapacitation.	X	X	X	X	X	X		
(03)		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				
(04)		Explain methods and procedures to cope with incapacitation in flight.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
040 03 00 00		**BASIC AVIATION PHYSIOLOGY**								
040 03 01 00		**Human performance processing**								
040 03 01 01		**Attention and vigilance**								
(01)		Differentiate between 'attention' and 'vigilance'.	X	X	X	X	X	X		
(02)		Differentiate between 'selective' and 'divided' attention.	X	X	X	X	X	X		
(03)		Define 'hypovigilance'.	X	X	X	X	X	X		
(04)		Identify the factors that may affect the state of vigilance.	X	X	X	X	X	X		
(05)		List the factors that may forestall hypovigilance during flight.	X	X	X	X	X	X		
(06)		Indicate the signs of reduced vigilance.	X	X	X	X	X	X		
(07)		List the factors that affect a person's level of attention.	X	X	X	X	X	X		
040 03 01 02		**Perception**								
(01)		Name the basis of the perceptual process.	X	X	X	X	X	X		
(02)		Describe the mechanism of perception ('bottom-up'/ 'topdown' process).	X	X	X	X	X	X		
(03)		Illustrate why perception is subjective and state the relevant factors that influence interpretation of perceived information.	X	X	X	X	X	X		
(04)		Describe some basic perceptual illusions.	X	X	X	X	X	X		
(05)		Illustrate some basic perceptual concepts.	X	X	X	X	X	X		
(06)		Give examples where perception plays a decisive role in flight safety.	X	X	X	X	X	X		
(07)		Stress how persuasive and believable mistaken perception can manifest itself both for an individual and a group.	X	X	X	X	X	X		
040 03 01 03		**Memory**								
(01)		Explain the link between the types of memory (to include sensory,	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		working/short-term and long-term memory).								
(02)		Describe the differences between the types of memory in terms of capacity and retention time.	X	X	X	X	X	X		
(03)		Justify the importance of sensory-store memories in processing information.	X	X	X	X	X	X		
(04)		State the average maximum number of separate items that may be held in working memory (5 ± 2).	X	X	X	X	X	X		
(05)		Stress how interruption can affect short-term/working memory.	X	X	X	X	X	X		
(06)		Give examples of items that are important for pilots to hold in working memory during flight.	X	X	X	X	X	X		
(07)		Describe how the capacity of the working-memory store may be increased.	X	X	X	X	X	X		
(08)		State the subdivisions of long-term memory and give examples of their content.	X	X	X	X	X	X		
(09)		Explain that skills are kept primarily in the long-term memory.	X	X	X	X	X	X		
(10)		Describe amnesia and how it affects memory.	X	X	X	X	X	X		
(11)		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								
(01)		Explain and distinguish between the following basic forms of learning: — classic and operant conditioning (behaviouristic approach);	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— learning by insight (cognitive approach); — learning by imitating (modelling).								
(02)		Recognise pilot-related examples as behaviouristic, cognitive or modelling forms of learning.	X	X	X	X	X	X		
(03)		State the factors that are necessary for and promote the quality of learning: — intrinsic motivation; — good mental health; — rehearsals for improvement of memory; — consciousness; — vigilance; — application in practical exercises.	X	X	X	X	X	X		
(04)		Explain ways to facilitate the memorisation of information with the following learning techniques: — mnemonics; — mental training.	X	X	X	X	X	X		
(05)		Describe the advantage of planning and anticipation of future actions: — define the term ‘skills’; — state the three phases of learning a skill (Anderson: cognitive, associative and autonomous phase).	X	X	X	X	X	X		
(06)		Explain the term ‘motor programme’ or ‘mental schema’.	X	X	X	X	X	X		
(07)		Describe the advantages and disadvantages of mental schemas.	X	X	X	X	X	X		
(08)		Explain the Rasmussen model which describes the guidance of a pilot’s behaviour in different situations.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		State the possible problems or risks associated with skill-, rule- and knowledge-based behaviour.	X	X	X	X	X	X		
		Motivation								
(10)		Define 'motivation'.	X	X	X	X	X	X		
(11)		Explain the relationship between motivation and learning.	X	X	X	X	X	X		
(12)		Explain the problems of over-motivation, especially in the context of the extreme need to achieve.	X	X	X	X	X	X		
040 03 02 00		**Human error and reliability**								
040 03 02 01		**Reliability of human behaviour**								
(01)		Name and explain the factors that influence human reliability.	X	X	X	X	X	X		
040 03 02 02		**Mental models and situation awareness**								
(01)		Define the term 'situation awareness'.	X	X	X	X	X	X	X	
(02)		List the cues that indicate loss of situation awareness and name the steps to regain it.	X	X	X	X	X	X	X	
(03)		List the factors that 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	X	
(04)		Define the term 'mental model' in relation to a surrounding complex situation.	X	X	X	X	X	X	X	
(05)		Describe the advantages/disadvantages of mental models.	X	X	X	X	X	X	X	
(06)		Explain the relationship between personal 'mental models' and the creation of cognitive illusions.	X	X	X	X	X	X	X	
040 03 02 03		**Theory and model of human error**								
(01)		Explain the concept of the 'error chain'.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Differentiate between an isolated error and an error chain.	X	X	X	X	X	X	X	
(03)		Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations).	X	X	X	X	X	X	X	
(04)		Discuss the above errors and their relevance in flight.	X	X	X	X	X	X	X	
(05)		Distinguish between an active and a latent error, and give examples.	X	X	X	X	X	X	X	
040 03 02 04		**Error generation**								
(01)		Distinguish between internal and external factors in error generation.	X	X	X	X	X	X	X	
(02)		Identify possible sources of internal error generation.	X	X	X	X	X	X	X	
(03)		Define and discuss the two errors associated with motor programmes (action slip and environmental capture).	X	X	X	X	X	X	X	
(04)		List the three main sources of external error generation in the flight crew compartment.	X	X	X	X	X	X	X	
(05)		Give examples to illustrate the following factors in external error generation in the flight crew compartment: — ergonomics; — economics; — social environment.	X	X	X	X	X	X	X	
(06)		Name the major goals in the design of human-centred human– machine interfaces.	X	X	X	X	X	X	X	
(07)		Define the term ‘error tolerance’.	X	X	X	X	X	X	X	
(08)		List and describe the strategies that are used to reduce human error.	X	X	X	X	X	X	X	
(09)		Describe the advantage of planning and the anticipation of future actions.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
040 03 03 00		**Decision-making**								
040 03 03 01		**Decision-making concepts**								
(01)		Define the terms ‘deciding’ and ‘decision-making’.	X	X	X	X	X	X	X	
(02)		Describe the major factors on which decision-making should be based during the course of a flight.	X	X	X	X	X	X	X	
(03)		Describe the main human attributes with regard to decision-making.	X	X	X	X	X	X	X	
(04)		Discuss the nature of bias and its influence on the decision-making process.	X	X	X	X	X	X	X	
(05)		Describe the main error sources and limits in an individual’s decision-making mechanism.	X	X	X	X	X	X	X	
(06)		State the factors upon which an individual’s risk assessment is based.	X	X	X	X	X	X	X	
(07)		Explain the relationship between risk assessment, commitment and pressure of time in decision-making strategies.	X	X	X	X	X	X	X	
(08)		Explain the risks associated with dispersion 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	X	
(09)		Describe the positive and negative influences exerted by other group members on an individual’s decision-making process (risky shift).	X	X	X	X	X	X	X	
(10)		Explain the general idea behind the creation of a model for decision-making based upon: — definition of the aim; — collection of information; — risk assessment;	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— development of options; — evaluation of options; — decision; — implementation; — consequences; — review and feedback.								
040 03 04 00		**Avoiding and managing errors: cockpit management**								
040 03 04 01		**Safety awareness**								
(01)		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 or risks.	X	X	X	X	X	X	X	
040 03 04 02		**Coordination (multi-crew concepts)**								
(01)		Name the objectives of the multi-crew concept.	X		X	X				
(02)		State and explain the elements of multi-crew concepts.	X		X	X				
(03)		Describe the concepts of 'standard operating procedures' (SOPs), checklists and crew briefings.	X	X	X	X	X			
(04)		Describe the purpose of and procedure for crew briefings.	X	X	X	X	X			
(05)		Describe the purpose of and procedure for checklists.	X	X	X	X	X			
(06)		Describe the function of communication in a coordinated team.	X		X	X				
(07)		Explain the advantages of SOPs.	X	X	X	X	X			
(08)		Explain how SOPs contribute to avoiding, reducing and managing threats and errors.	X	X	X	X	X			
(09)		Explain potential threats of SOPs, for example during company or type conversion (e.g. motor programmes,	X	X	X	X	X			

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		company culture, hazardous attitudes, developed habits).								
040 03 04 03		**Cooperation**								
(01)		Distinguish between cooperation and coaction.	X	X	X	X	X			
(02)		Define the term ‘group’.	X	X	X	X	X			
(03)		Illustrate the influence of interdependence in a group.	X	X	X	X	X			
(04)		List the advantages and disadvantages of teamwork.	X	X	X	X	X			
(05)		Explain the term ‘synergy’.	X	X	X	X	X			
(06)		Define the term ‘cohesion’.	X	X	X	X	X			
(07)		Define the term ‘groupthink’.	X	X	X	X	X			
(08)		State the essential conditions for good teamwork.	X	X	X	X	X			
(09)		Explain the function of role and norm in a group.	X	X	X	X	X			
(10)		Name the different role patterns which occur in a group situation.	X	X	X	X	X			
(11)		Explain how behaviour can be affected by the following factors: — persuasion; — conformity; — compliance; — obedience.	X	X	X	X	X			
(12)		Distinguish between status and role.	X	X	X	X	X			
(13)		Stress the inherent dangers of a situation where there is a mix of role and status within the flight crew compartment.	X	X	X	X	X			
(14)		Explain the terms ‘leadership’ and ‘followership’.	X	X	X	X	X			
(15)		Describe the trans-cockpit authority gradient and its affiliated leadership styles	X	X	X	X	X			

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		(i.e. autocratic, laissez-faire and synergistic).								
(16)		Name the most important attributes of a positive leadership style.	X	X	X	X	X			
040 03 04 04		**Communications**								
(01)		Define the term 'communication'.	X	X	X	X	X	X		
(02)		List the most basic components of interpersonal communication.	X	X	X	X	X	X		
(03)		Explain the advantages of in-person two-way communication as opposed to one-way communication.	X	X	X	X	X	X		
(04)		*Intentionally left blank*								
(05)		Name the importance of non-verbal communication.	X	X	X	X	X	X		
(06)		Describe the general aspects of non-verbal communication.	X	X	X	X	X	X		
(07)		Describe the advantages/disadvantages of implicit and explicit communication.	X	X	X	X	X	X		
(08)		Describe the advantages and possible problems of using 'social' and 'professional' language in high- and low-workload situations.	X	X	X	X	X	X		
(09)		Name and explain the major obstacles to effective communication.	X	X	X	X	X	X		
(10)		Explain the difference between intrapersonal and interpersonal conflict.	X	X	X	X	X	X		
(11)		Describe the escalation process in human conflict.	X	X	X	X	X	X		
(12)		List the typical consequences of conflicts between crew members.	X	X	X	X	X	X		
(13)		Explain the following terms as part of the communication practice with regard to preventing or resolving conflicts: — inquiry;	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— active listening; — advocacy; — feedback; — metacommunication; — negotiation.								
(14)		Describe the limitations of communication in situations of high workload in the flight crew compartment in view of listening, verbal, non-verbal and visual effects.	X	X	X	X	X	X		
040 03 05 00		**Human behaviour**								
040 03 05 01		**Personality, attitude and behaviour**								
(01)		Describe the factors that determine an individual's behaviour	X	X	X	X	X	X		
(02)		Define and distinguish between 'personality', 'attitude' and 'behaviour'.	X	X	X	X	X	X		
(03)		State the origin of personality and attitude.	X	X	X	X	X	X		
(04)		State that with behaviour good and bad habits can be formed.	X	X	X	X	X	X		
(05)		Explain how behaviour is generally a product of personality, attitude and the environment to which one was exposed at significant moments (childhood, schooling and training).	X	X	X	X	X	X		
(06)		State that personality differences and selfish attitude may have effects on flight crew performance.	X	X	X	X	X	X		
040 03 05 02		**Individual differences in personality and motivation**								
(01)		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		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Self-concept								
(02)		Define 'self-concept' and the role it plays in any change of personality.	X	X	X	X	X	X		
(03)		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								
(04)		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)**								
(01)		Explain dangerous attitudes in aviation: — anti-authority; — macho; — impulsivity; — invulnerability; — complacency; — resignation.	X	X	X	X	X			
(02)		Describe the personality, attitude and behaviour patterns of an ideal crew member.	X	X	X	X	X			
(03)		Summarise how a person's attitude influences their work in the flight crew compartment.	X	X	X	X	X			
040 03 06 00		**Human overload and underload**								
040 03 06 01		**Arousal**								
(01)		Explain the term 'arousal'.	X	X	X	X	X	X		
(02)		Describe the relationship between arousal and performance.	X	X	X	X	X	X		
(03)		Explain the circumstances under which underload may occur and its possible dangers.	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain the relationship between arousal and stress.	X	X	X	X	X	X		
(05)		State the relationship between stress and performance.	X	X	X	X	X	X	X	
(06)		State the basic categories of stressors.	X	X	X	X	X	X	X	
(07)		List and discuss the major environmental sources of stress in the flight crew compartment.	X	X	X	X	X	X	X	
(08)		Discuss the concept of 'break point' with regard to stress, overload and performance.	X	X	X	X	X	X	X	
(09)		Name the principal causes of domestic stress.	X	X	X	X	X	X		
(10)		State that the stress experienced as a result of particular demands varies among individuals.	X	X	X	X	X	X		
(11)		Explain the factors that lead to differences in the levels of stress experienced by individuals.	X	X	X	X	X	X	X	
(12)		List the factors that influence the tolerance of stressors.	X	X	X	X	X	X		
(13)		State that stress is a result of perceived demands and perceived ability.	X	X	X	X	X	X		
(14)		Explain the relationship between stress and anxiety.	X	X	X	X	X	X	X	
(15)		Describe the effects of anxiety on human performance.	X	X	X	X	X	X	X	
(16)		State the general effect of acute stress on people.	X	X	X	X	X	X	X	
(17)		Describe the relationship between stress, arousal and vigilance.	X	X	X	X	X	X		
(18)		State the general effect of chronic stress and the biological reaction by means of the three stages of the general adaptation	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		syndrome (Selye): alarm, resistance, and exhaustion.								
(19)		Explain the differences between psychological, psychosomatic and somatic stress reactions.	X	X	X	X	X	X		
(20)		Name the typical common physiological and psychological symptoms of human overload.	X	X	X	X	X	X		
(21)		Describe the effects of stress on human behaviour.	X	X	X	X	X	X		
(22)		Explain how stress is cumulative and how stress from one situation can be transferred to a different situation.	X	X	X	X	X	X	X	
(23)		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	X	
(24)		Describe the effect of human underload/overload on effectiveness in the flight crew compartment.	X	X	X	X	X	X	X	
(25)		List sources and symptoms of human underload.	X	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**								
(01)		Explain the term ‘fatigue’ and differentiate between the two types of fatigue (short-term and chronic fatigue).	X	X	X	X	X	X		
(02)		Name the causes of short-term and chronic fatigue.	X	X	X	X	X	X		
(03)		Identify the symptoms and describe the effects of fatigue.	X	X	X	X	X	X		
(04)		List the strategies that prevent or delay the onset of fatigue and hypovigilance.	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		List and describe strategies for coping with stress factors and stress reactions.	X	X	X	X	X	X		
(06)		Distinguish between short-term and long-term methods of stress management.	X	X	X	X	X	X		
(07)		Give examples of short-term methods of stress management.	X	X	X	X	X	X		
(08)		Give examples of long-term methods of coping with stress.	X	X	X	X	X	X		
(09)		Describe the fatigue risk management system (FRMS) as follows: a data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.	X	X	X	X	X	X		
040 03 07 00		**Advanced cockpit automation**								
040 03 07 01		**Advantages and disadvantages**								
(01)		Compare the two basic concepts of automation: — as per Boeing, where the pilot remains the last operator; — and as per Airbus, where automated systems can correct erroneous pilot action.	X	X	X	X	X	X	X	
(02)		Explain the fundamental restrictions of autoflight systems to be lack of creativity in unknown situations, and lack of personal motivation with regard to safety.	X	X	X	X	X	X	X	
(03)		List the principal strengths and weaknesses of pilot versus autopilot systems to be creativity, decision-making,	X	X	X	X	X	X	X	

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		prioritisation of tasks, safety attitude versus precision, reliability.								
(04)		Explain the 'ironies of automation': designers' errors due to wrong interpretation of the data, leaving tasks to the pilot that are too complex to automate, loss of manual and cognitive skills of the pilot. State the necessity for regular training flights as one possible countermeasure.	X	X	X	X	X	X	X	
(05)		Describe methods to overcome the drawbacks of autoflight systems to be loss of manual flying capabilities, additional workload through programming, risk of slips during programming, and hypovigilance during cruise.	X	X	X	X	X	X	X	
040 03 07 02		**Automation complacency**								
(01)		State the main weaknesses in the monitoring of automatic systems to be hypovigilance during flight, and loss of flying skills.	X	X	X	X	X	X	X	
(02)		Explain some basic flight crew errors and terms that arise with the introduction of automation: — passive monitoring; — blinkered concentration; — confusion; — mode awareness.	X	X	X	X	X	X	X	
(03)		Explain how the method of call-outs counteracts ineffective monitoring of automatic systems.	X	X	X	X	X	X	X	
(04)		Define 'complacency'.	X	X	X	X	X	X	X	
040 03 07 03		**Working concepts**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain that the potential disadvantages of automation on crew communication are loss of awareness of input errors, flight modes, failure detection, failure comprehension, status of the aircraft and aircraft position.	X		X	X				
(02)		Explain how the negative effects of automation on pilots may be alleviated by degrading to a lower level of automation to recover comprehension of the flight status from VNAV/LNAV to ALT/HDG or even to manual flying.	X	X	X	X	X	X	X	
(03)		Interpret the role of automation with respect to flight safety regarding the basic principle of the use of manual versus autoflight in normal operations, frequent changes in the flight profile, and in abnormal situations.	X	X	X	X	X	X	X	

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SUBJECT 050 – METEOROLOGY

The operation of an aircraft is affected by the weather conditions within the atmosphere. The pilot should prove that they fulfil the following objectives in order to complete a flight safely in given meteorological conditions.

(1) Training aims

(i) Knowledge. After completion of the training, the pilot should be able to:

— understand the physical processes in the atmosphere;

— interpret the actual and forecast weather conditions in the atmosphere; and

— demonstrate understanding of the meteorological hazards and their effects on aircraft.

(ii) Skills. After completion of the training, the pilot should 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; and

— resolve any problems presented by the given weather conditions.

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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**								
(01)		Describe the vertical division of the atmosphere up to flight level (FL) 650, based on the temperature variations with height.	X	X	X	X	X	X	X	
(02)		List the different layers and their main qualitative characteristics up to FL 650.	X	X	X	X	X	X	X	
051 01 01 02		**Troposphere**								
(01)		Describe the troposphere.	X	X	X	X	X	X	X	
(02)		Describe the main characteristics of the tropopause.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe the proportions of the most important gases in the air in the troposphere.	X	X	X	X	X	X	X	
(04)		Describe the variations of the FL and temperature of the tropopause from the poles to the equator.	X	X	X	X	X	X	X	
(05)		Describe the breaks in the tropopause along the boundaries of the main air masses	X	X	X	X	X	X	X	
(06)		Indicate the variations of the FL of the tropopause with the seasons and the variations of atmospheric pressure.	X		X	X				
050 01 01 03		**Stratosphere**								
(01)		Describe the stratosphere up to FL 650.	X							
(02)		Describe that ozone can occur at jet cruise altitudes and that it constitutes a hazard.	X		X	X				
050 01 02 00		**Air temperature**								
050 01 02 01		**Definition and units**								
(01)		Define 'air temperature'.	X	X	X	X	X	X	X	
(02)	X	List the units of measurement of air temperature used in aviation meteorology (Celsius, Fahrenheit, Kelvin). (Refer to Subject 050 10 01 01)	X	X	X	X	X	X	X	
050 01 02 02		**Vertical distribution of temperature**								
(01)		Describe the mean vertical distribution of temperature up to FL 650.	X	X	X	X	X	X	X	
(02)		Mention the general causes of the cooling of the air in the troposphere with increasing altitude.	X	X	X	X	X	X	X	
(03)		Calculate the temperature and temperature deviations (in relation to International Standard Atmosphere (ISA)) at specified levels.	X	X	X	X	X	X	X	
050 01 02 03		**Transfer of heat**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain how local cooling or warming processes result in transfer of heat.	X	X	X	X	X	X	X	
(02)		Describe radiation.	X	X	X	X	X	X	X	
(03)		Describe solar radiation reaching the Earth.	X	X	X	X	X	X	X	
(04)		Describe the filtering effect of the atmosphere on solar radiation.	X	X	X	X	X	X	X	
(05)		Describe terrestrial radiation.	X	X	X	X	X	X	X	
(06)		Explain how terrestrial radiation is absorbed by some components of the atmosphere.	X	X	X	X	X	X	X	
(07)		Explain the effect of absorption and radiation in connection with clouds.	X	X	X	X	X	X	X	
(08)		Explain the process of conduction	X	X	X	X	X	X	X	
(09)		Explain the role of conduction in the cooling and warming of the atmosphere.	X	X	X	X	X	X	X	
(10)		Explain the process of convection.	X	X	X	X	X	X	X	
(11)		Name the situations in which convection occurs.	X	X	X	X	X	X	X	
(12)		Explain the process of advection.	X	X	X	X	X	X	X	
(13)		Name the situations in which advection occurs.	X	X	X	X	X	X	X	
(14)		Describe the transfer of heat by turbulence.	X	X	X	X	X	X	X	
(15)		Describe the transfer of latent heat.	X	X	X	X	X	X	X	
050 01 02 04		**Lapse rates**								
(01)		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	X	
050 01 02 05		**Development of inversions, types of inversions**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the development and types of inversions.	X	X	X	X	X	X	X	
(02)		Explain the characteristics of inversions and of an isothermal layer concerning stability and vertical motions.	X	X	X	X	X	X	X	
(03)		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	X	
050 01 02 06		**Temperature near the Earth's surface, insolation, surface effects, effect of clouds, effect of wind**								
(01)		Explain the cooling/warming of the surface of the Earth by radiation.	X	X	X	X	X	X	X	
(02)		Explain the cooling/warming of the air by molecular or turbulent heat transfer to/from the earth or sea surfaces.	X	X	X	X	X	X	X	
(03)		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	X	
(04)		Explain the influence of the wind on the cooling and warming of the air near the surfaces.	X	X	X	X	X	X	X	
050 01 03 00		**Atmospheric pressure**								
050 01 03 01		**Barometric pressure, isobars**								
(01)		Define 'atmospheric pressure'.	X	X	X	X	X	X	X	
(02)	X	List he units of measurement of the atmospheric pressure used in aviation (hPa, inches of mercury).	X	X	X	X	X	X	X	
(03)	X	Describe the principle of the barometers (mercury barometer, aneroid barometer).	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Define isobars and identify them on surface weather charts.	X	X	X	X	X	X	X	
(05)		Define ‘high’, ‘low’, ‘trough’, ‘ridge’, ‘col’.	X	X	X	X	X	X	X	
050 01 03 02		**Pressure variation with height, contours (isohypses)**								
(01)		Explain the pressure variation with height.	X	X	X	X	X	X	X	
(02)		Describe quantitatively the variation of the barometric lapse rate. *Remark: An approximation of the average value for the barometric lapse rate near mean sea level (MSL) is 30 ft (9 m) per 1 hPa.*	X	X	X	X	X	X	X	
(03)		State that (under conditions of ISA) pressure is approximately 50 % of MSL at 18 000 ft and density is approximately 50 % of MSL at 22 000 ft and 25 % of MSL at 40 000 ft.	X	X	X	X	X	X	X	
050 01 03 03		**Reduction of pressure to QFF (MSL)**								
(01)		Define ‘QFF’.	X	X	X	X	X	X	X	
(02)		Explain the reduction of measured pressure (QFE) to QFF (MSL).	X	X	X	X	X	X	X	
(03)		Mention the use of QFF for surface weather charts.	X	X	X	X	X	X	X	
050 01 03 04		**Relationship between surface pressure centres and pressure centres aloft**								
(01)		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	X	
050 01 04 00		**Air density**								
050 01 04 01		**Relationship between pressure, temperature and density**								
(01)		Describe the relationship between pressure, temperature and density.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the vertical variation of the air density in the atmosphere.	X	X	X	X	X	X	X	
050 01 05 00		**International Standard Atmosphere (ISA)**								
050 01 05 01		**International Standard Atmosphere (ISA)**								
(01)		Explain the use of standardised values for the atmosphere.	X	X	X	X	X	X	X	
(02)		List the main values of the ISA MSL pressure, MSL temperature, the vertical temperature lapse rate up to FL 650, height and temperature of the tropopause.	X	X	X	X	X	X	X	
050 01 06 00		**Altimetry**								
050 01 06 01		**Terminology and definitions**								
(01)		Define the following terms and explain how they are related to each other: height, altitude, pressure altitude, FL, pressure level, true altitude, true height, elevation, QNH, QFE, and standard altimeter setting.	X	X	X	X	X	X	X	
(02)		Describe the terms ‘transition altitude’, ‘transition level’, ‘transition layer’, ‘terrain clearance’, ‘lowest usable flight level’.	X	X	X	X	X	X	X	
050 01 06 02		**Altimeter settings**								
(01)		Name the altimeter settings associated to height, altitude, pressure altitude and FL.	X	X	X	X	X	X	X	
(02)		Describe the altimeter-setting procedures.	X	X	X	X	X	X	X	
050 01 06 03		**Calculations**								
(01)		Calculate the different readings on the altimeter when the pilot uses different settings (QNH, 1013.25, QFE).	X	X	X	X	X	X	X	
(02)		Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		pilot climbs through the transition altitude or descends through the transition level.								
(03)		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	X	
(04)		Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two FLs.	X	X	X	X	X	X	X	
(05)		Explain the influence of pressure areas on true altitude.	X	X	X	X	X	X	X	
(06)		Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation.	X	X	X	X	X	X	X	
(07)		Calculate the terrain clearance and the lowest usable FL for given atmospheric temperature and pressure conditions.	X	X	X	X	X	X	X	
(08)		State that the 4 %-rule can be used to calculate true altitude from indicated altitude, and also indicated altitude from true altitude (not precise but sufficient due to the approximation of the 4%- rule.) *Remark: The following rules should 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 between MSL and 700 hPa to be used is 30 ft/hPa as an acceptable approximation of the barometric lapse rate.*	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		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 the outside-air temperature from ISA is considered to be constantly the same given value in the whole layer.* *e) The elevation of the aerodrome has to be taken into account. The temperature correction has to be considered for the layer between the ground and the position of the aircraft.*								
050 01 06 04		**Effects of accelerated airflow due to topography**								
(01)		Describe qualitatively how the effect of accelerated airflow due to topography (the Bernoulli effect) affects altimetry.								
050 02 00 00		**WIND**								
050 02 01 00		**Definition and measurement of wind**								
050 02 01 01		**Definition and measurement**								
(01)		Define 'wind' and 'surface wind'.	X	X	X	X	X	X	X	
(02)		State the units of wind directions (degrees true in reports; degrees magnetic from tower) and speed (kt, m/s).	X	X	X	X	X	X	X	
(03)		Describe that the reported wind is an average wind derived from measurements with an anemometer at a height of 10 m over 2 min for local routine and special reports and ATS units, and over 10 min for aerodrome routine meteorological reports	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		(METARs) and aerodrome special meteorological reports (SPECIs).								
050 02 02 00		**Primary cause of wind**								
050 02 02 01		**Primary cause of wind, pressure gradient, Coriolis force, gradient wind**								
(01)		Define the term 'horizontal pressure gradient'.	X	X	X	X	X	X	X	
(02)		Explain how the pressure gradient force acts in relation to the pressure gradient.	X	X	X	X	X	X	X	
(03)		Explain how the Coriolis force acts in relation to the wind.	X	X	X	X	X	X	X	
(04)		Explain the development of the geostrophic wind.	X	X	X	X	X	X	X	
(05)		Indicate how the geostrophic wind flows in relation to the isobars/isohypses in the northern and in the southern hemisphere.	X	X	X	X	X	X	X	
(06)		Analyse the effect of changing latitude on the geostrophic wind speed.	X	X	X	X	X	X	X	
(07)		Explain the gradient wind effect and indicate how the gradient wind differs from the geostrophic wind in cyclonic and anticyclonic circulation.	X	X	X	X	X	X	X	
050 02 02 02		**Variation of wind in the friction layer**								
(01)		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	X	X	X	X	X	X	
(02)		State the surface and air-mass conditions that influence the wind in the friction layer (diurnal variation).	X	X	X	X	X	X	X	
(03)		Name terrain, wind speed and stability as the main factors that influence the vertical extent of the friction layer.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives			Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
					ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain the relationship between isobars and wind (direction and speed).			X	X	X	X	X	X	X	
		Remark: Approximate value for variation of wind in the friction layer (values to be used in examinations):										
		Type of landscape	Wind speed in friction layer in % of the geostrophic wind	The wind in the friction layer blows across the isobars towards the low pressure. Angle between wind direction and isobars.								
		Over water	ca 70 %	ca 10°								
		Over land	ca 50 %	ca 30°								
		WMO - No. 266										
050 02 02 03		**Effects of convergence and divergence**										
(01)		Describe atmospheric convergence and divergence.			X	X	X	X	X	X	X	
(02)		Explain the relationship between 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	X	X	X	X	X	X	
050 02 03 00		**General global circulation**										
050 02 03 01		**General circulation around the globe**										

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the general global circulation. (Refer to Subject 050 08 01 01)	X	X	X	X	X	X	X	
(02)		Describe mountain and valley winds.	X	X	X	X	X	X	X	
(03)		Describe the Venturi effect, convergence in valleys and mountain areas.	X	X	X	X	X	X	X	
(04)		Describe land and sea breezes, and sea-breeze front.	X	X	X	X	X	X	X	
(05)		Describe that local, low-level jet streams can develop in the evening.	X	X	X	X	X	X	X	
050 02 05 00		**Mountain waves (standing waves, lee waves)**								
050 02 05 01		**Origin and characteristics**								
(01)		Explain the origin and formation of mountain waves.	X	X	X	X	X	X	X	
(02)		State the conditions necessary for the formation of mountain waves.	X	X	X	X	X	X	X	
(03)		Describe the structure and properties of mountain waves.	X	X	X	X	X	X	X	
(04)		Explain how mountain waves may be identified by their associated meteorological phenomena.	X	X	X	X	X	X	X	
(05)		Describe that mountain wave effects can exceed the performance or structural capability of aircraft.	X	X	X	X	X	X	X	
(06)		Describe that mountain wave effects can propagate from low to high level, e.g. over Greenland and elsewhere.	X	X	X	X	X	X	X	
050 02 06 00		**Turbulence**								
050 02 06 01		**Description and types of turbulence**								
(01)		Describe turbulence and gustiness.	X	X	X	X	X	X	X	
(02)		List the common types of turbulence (convective, mechanical, orographic, frontal, clear-air turbulence).	X	X	X	X	X	X	X	
050 02 06 02		**Formation and location of turbulence**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the formation of convective turbulence, mechanical and orographic turbulence, and frontal turbulence.	X	X	X	X	X	X	X	
(02)		State where turbulence will normally be found (rough-ground surfaces, relief, inversion layers, cumulonimbus (CB), thunderstorm (TS) zones, unstable layers).	X	X	X	X	X	X	X	
050 02 06 03		**Clear-air turbulence (CAT) – description, cause and location**								
(01)		Describe CAT.	X	X				X	X	
(02)		Describe the formation of CAT.	X	X	X	X	X	X	X	
(03)		State where CAT is found in association with jet streams, in high-level troughs and in other disturbed high-level air flows. (Refer to Subject 050 09 02 02)	X							
(04)		State that remote sensing of CAT from satellites is not possible and that forecasting is limited.	X	X	X	X	X	X	X	
(05)		State that pilot reports of turbulence are a very valuable source of information as remote measurements are not available.	X	X	X	X	X	X	X	
050 02 07 00		**Jet streams**								
050 02 07 01		**Description**								
(01)		Describe jet streams.	X	X				X	X	
(02)		State the defined minimum speed of a jet stream (60 kt).	X	X				X	X	
(03)		State the typical figures for the dimensions of jet streams.	X	X				X	X	
050 02 07 02		**Formation and properties of jet stream**								
(01)		Explain the formation and state the heights, the speeds, the seasonal variations of speeds, the geographical positions, the seasonal occurrence and	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		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.								
050 02 07 03		**Location of jet streams and associated CAT areas**								
(01)		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						
(02)		Describe and indicate the areas of worst wind shear and CAT.	X	X						
050 02 07 04		**Intentionally left blank**								
050 03 00 00		**THERMODYNAMICS**								
050 03 01 00		**Humidity**								
050 03 01 01		**Water vapour in the atmosphere**								
(01)		State that the density of moist air is less than the density of dry air.	X	X	X	X	X	X	X	
(02)		Describe the significance for meteorology of water vapour in the atmosphere.	X	X	X	X	X	X	X	
(03)		Indicate the sources of atmospheric humidity.	X	X	X	X	X	X	X	
(04)		Define ‘saturation of air by water vapour’.	X	X	X	X	X	X		
050 03 01 02		**Intentionally left blank**								
050 03 01 03		**Temperature/dew point, relative humidity**								
(01)		Define ‘dew point’.	X	X	X	X	X	X	X	
(02)		Define ‘relative humidity’.	X	X	X	X	X	X	X	
(03)		Explain the factors that influence the relative humidity at constant pressure.	X	X	X	X	X	X	X	
(04)		Explain the diurnal variation of the relative humidity.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe the relationship between temperature and dew point.	X	X	X	X	X	X	X	
(06)		Estimate the relative humidity of the air from the difference between dew point and temperature.	X	X	X	X	X	X	X	
050 03 02 00		**Change of state of water**								
050 03 02 01		**Condensation, evaporation, sublimation, freezing and melting, latent heat**								
(01)		Define 'condensation', 'evaporation', 'sublimation', 'freezing and melting' and 'latent heat'.	X	X	X	X	X	X	X	
(02)		List the conditions for condensation/evaporation.	X	X	X	X	X	X	X	
(03)		Explain the condensation process.	X	X	X	X	X	X	X	
(04)		Explain the nature of and the need for condensation nuclei.	X	X	X	X	X	X	X	
(05)		Explain the effects of condensation on the weather.	X	X	X	X	X	X	X	
(06)		List the conditions for freezing/melting.	X	X	X	X	X	X	X	
(07)		Explain the process of freezing.	X	X	X	X	X	X	X	
(08)		Explain the nature of and the need for freezing nuclei.	X	X	X	X	X	X	X	
(09)		Define 'supercooled water'. (Refer to Subject 050 09 01 01)	X	X	X	X	X	X	X	
(10)		List the conditions for sublimation.	X	X	X	X	X	X	X	
(11)		Explain the sublimation process.	X	X	X	X	X	X	X	
(12)		Explain the nature of and the need for sublimation nuclei.	X	X	X	X	X	X	X	
(13)		Describe the absorption or release of latent heat in each change of state of water.	X	X	X	X	X	X	X	
(14)		Illustrate all the changes of state of water with practical examples.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 03 03 00		**Adiabatic processes**								
050 03 03 01		**Adiabatic processes, stability of the atmosphere**								
(01)		Describe the adiabatic process in an unsaturated rising or descending air particle.	X	X	X	X	X	X	X	
(02)		Explain the variation of temperature of an unsaturated rising or descending air particle.	X	X	X	X	X	X	X	
(03)		Explain the variation of humidity of an unsaturated rising or descending air particle.	X	X	X	X	X	X	X	
(04)		Describe the adiabatic process in a saturated rising or descending air particle.	X	X	X	X	X	X	X	
(05)		Explain the variation of temperature of a saturated air particle with changing altitude.	X	X	X	X	X	X	X	
(06)		Explain the static stability of the atmosphere using the actual temperature curve with reference to the adiabatic lapse rates.	X	X	X	X	X	X	X	
(07)		Define qualitatively and quantitatively the terms ‘stable’, ‘conditionally unstable’, ‘unstable’ and ‘indifferent’.	X	X	X	X	X	X	X	
(08)		Illustrate with a schematic sketch the formation of Foehn.	X	X	X	X	X	X	X	
(09)		Explain the effect of the advection of air (warm or cold) on the stability of the air. *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	X	
050 04 00 00		**CLOUDS AND FOG**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 04 01 00		**Cloud formation and description**								
050 04 01 01		**Cloud formation**								
(01)		Explain cloud formation by adiabatic cooling, conduction, advection and radiation.	X	X	X	X	X	X	X	
(02)		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	X	
(03)		List cloud types typical for stable and unstable air conditions	X	X	X	X	X	X	X	
(04)		Summarise the conditions for the dissipation of clouds.	X	X	X	X	X	X	X	
050 04 01 02		**Cloud types and cloud classification**								
(01)		Describe the different cloud types and their classification.	X	X	X	X	X	X	X	
(02)		Identify by shape cirriform, cumuliform and stratiform clouds.	X	X	X	X	X	X	X	
(03)		Identify by shape and typical level the 10 cloud types (general).	X	X	X	X	X	X	X	
(04)		Describe and identify by shape the following species and supplementary features: castellanus, lenticularis, congestus, calvus, capillatus and virga.	X	X	X	X	X	X	X	
(05)		Distinguish between low-, medium- and high-level clouds according to the World Meteorological Organization's (WMO) 'cloud ètage'.	X	X	X	X	X	X	X	
(06)		Distinguish between ice clouds, mixed clouds and pure-water clouds.	X	X	X	X	X	X	X	
050 04 01 03		**Influence of inversions on cloud development**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the influence of inversions on vertical movements in the atmosphere.	X	X	X	X	X	X	X	
(02)		Explain the influence of an inversion on the formation of stratus clouds.	X	X	X	X	X	X	X	
(03)		Explain the influence of ground inversion on the formation of fog.	X	X	X	X	X	X	X	
(04)		Describe the role of the tropopause inversion with regard to the vertical development of clouds.	X	X	X	X	X	X	X	
050 04 01 04		**Flying conditions in each cloud type**								
(01)		Asses the 10 cloud types for icing and turbulence.	X	X	X	X	X	X	X	
050 04 02 00		**Fog, mist, haze**								
050 04 02 01		**General aspects**								
(01)		Define ‘fog’, ‘mist’ and ‘haze’ with reference to the WMO standards of visibility range.	X	X	X	X	X	X	X	
(02)		Explain briefly the formation of fog, mist and haze.	X	X	X	X	X	X	X	
(03)		Name the factors that generally contribute to the formation of fog and mist.	X	X	X	X	X	X	X	
(04)		Name the factors that contribute to the formation of haze.	X	X	X	X	X	X	X	
(05)		Describe freezing fog and ice fog.	X	X	X	X	X	X	X	
050 04 02 02		**Radiation fog**								
(01)		Explain the formation of radiation fog.	X	X	X	X	X	X	X	
(02)		Describe the different possibilities of advection-fog formation (over land, sea and coastal regions).	X	X	X	X	X	X	X	
(03)		Describe the significant characteristics of advection fog.	X	X	X	X	X	X	X	
(04)		Describe the significant characteristics of advection fog.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Summarise the conditions for the dissipation of advection fog.	X	X	X	X	X	X	X	
050 04 02 04		**Sea smoke**								
(01)		Explain the formation of sea smoke.	X	X	X	X	X	X	X	
(02)		Explain the conditions for the development of sea smoke.	X	X	X	X	X	X	X	
(03)		Summarise the conditions for the dissipation of sea smoke.	X	X	X	X	X	X	X	
050 04 02 05		**Frontal fog**								
(01)		Explain the formation of frontal fog.	X	X	X	X	X	X	X	
(02)		Describe the significant characteristics of frontal fog	X	X	X	X	X	X	X	
(03)		Summarise the conditions for the dissipation of frontal fog.	X	X	X	X	X	X	X	
050 04 02 06		**Orographic fog (hill fog)**								
(01)		Summarise the features of orographic fog.	X	X	X	X	X	X	X	
(02)		Describe the significant characteristics of orographic fog.	X	X	X	X	X	X	X	
(03)		Summarise the conditions for the dissipation of orographic fog.	X	X	X	X	X	X	X	
050 05 00 00		**PRECEPITATION**								
050 05 01 00		**Development of precipitation**								
050 05 01 01		**Process of development of precipitation**								
(01)		Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).	X	X	X	X	X	X	X	
(02)		Summarise the outlines of the ice-crystal process (The Wegener– Bergeron–Findeisen process).	X	X	X	X	X	X	X	
(03)		Summarise the outlines of the coalescence process.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain the development of snow, rain, drizzle and hail.	X	X	X	X	X	X	X	
050 05 02 00		**Types of precipitation**								
050 05 02 01		**Types of precipitation, relationship with cloud types**								
(01)		List and describe the types of precipitation given in the aerodrome forecast (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	X	
(02)		State the ICAO/WMO approximate diameters for cloud, drizzle and rain drops.	X	X	X	X	X	X	X	
(03)		State that, because of their size, hail stones can cause significant damage to aircraft.	X	X	X	X	X	X	X	
(04)	X	Explain the mechanism for the formation of freezing precipitation.	X	X	X	X	X	X	X	
(05)		Describe the weather conditions that give rise to freezing precipitation.	X	X	X	X	X	X	X	
(06)		Distinguish between the types of precipitation generated in convective and stratiform clouds.	X	X	X	X	X	X	X	
(07)		Assign typical precipitation types and intensities to different cloud types.	X	X	X	X	X	X	X	
(08)		Explain the relationship between moisture content and visibility during different types of winter precipitation (e.g. large vs small snowflakes).	X	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**								
(01)		Define the term ‘air mass’.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the properties of the source regions.	X	X	X	X	X	X	X	
(03)		Summarise the classification of air masses by source regions.	X	X	X	X	X	X	X	
(04)		State the classifications of air masses by temperature and humidity at source.	X	X	X	X	X	X	X	
(05)		State the characteristic weather in each of the air masses.	X	X	X	X	X	X	X	
(06)		Name the three main air masses that affect Europe.	X	X	X	X	X	X	X	
(07)		Classify air masses on a surface weather chart.	X	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**								
(01)		List the environmental factors that affect the final properties of an air mass.	X	X	X	X	X	X	X	
(02)		Explain how maritime and continental tracks modify air masses.	X	X	X	X	X	X	X	
(03)		Explain the effect of passage over cold or warm surfaces.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain how air-mass weather is affected by the season, the airmass track and by orographic and thermal effects over land.	X	X	X	X	X	X	X	
(05)		Assess the tendencies of the stability of an air mass and describe the typical resulting air-mass weather including the hazards for aviation.	X	X	X	X	X	X	X	
050 06 02 00		**Fronts**								
050 06 02 01		**General aspects**								
(01)		Describe the boundaries between air masses (fronts).	X	X	X	X	X	X	X	
(02)		Define ‘front’ and ‘frontal zone’.	X	X	X	X	X	X	X	
(03)		Name the global frontal systems (polar front, arctic front).	X	X	X	X	X	X		
(04)		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**								
(01)		Define a ‘warm front’.	X	X	X	X	X	X	X	
(02)		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	X	
(03)		Explain the seasonal differences in the weather at warm fronts.	X	X	X	X	X	X	X	
(04)		Describe the structure, slope and dimensions of a warm front.	X	X	X	X	X	X	X	
(05)		Sketch a cross section of a warm front showing weather, cloud and aviation hazards.	X	X	X	X	X	X	X	
050 06 02 03		**Cold front, associated clouds and weather**								
(01)		Define a ‘cold front’.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		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	X	
(03)		Explain the seasonal differences in the weather at cold fronts.	X	X	X	X	X	X	X	
(04)		Describe the structure, slope and dimensions of a cold front.	X	X	X	X	X	X	X	
(05)		Sketch a cross section of a cold front showing weather, cloud and aviation hazards.	X	X	X	X	X	X	X	
050 06 02 04		**Warm sector, associated clouds and weather**								
(01)		Describe fronts and air masses associated with the warm sector.	X	X	X	X	X	X	X	
(02)		Describe the cloud, weather, ground visibility and aviation hazards in a warm sector.	X	X	X	X	X	X	X	
(03)		Explain the seasonal differences in the weather in the warm sector.	X	X	X	X	X	X	X	
(04)		Sketch a cross section of a warm sector showing weather, cloud and aviation hazards.	X	X	X	X	X	X	X	
050 06 02 05		**Weather behind the cold front**								
(01)		Describe the cloud, weather, ground visibility and aviation hazards behind the cold front.	X	X	X	X	X	X	X	
(02)		Explain the seasonal differences in the weather behind the cold front.	X	X	X	X	X	X	X	
050 06 02 06		**Occlusions, associated clouds and weather**								
(01)	X	Define the term ‘occlusion’ and ‘occluded front’.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion.	X	X	X	X	X	X	X	
(03)		Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion.	X	X	X	X	X	X	X	
(04)		Explain the seasonal differences in the weather at occlusions.	X	X	X	X	X	X	X	
(05)		Sketch a cross section of occlusions showing weather, cloud and aviation hazards.	X	X	X	X	X	X	X	
(06)		On a sketch illustrate the development of an occlusion and the movement of the occlusion point.	X	X	X	X	X	X	X	
050 06 02 07		**Stationary front, associated clouds and weather**								
(01)		Define a ‘stationary front’.	X	X	X	X	X	X	X	
(02)		Describe the cloud, weather, ground visibility and aviation hazards in a stationary front.	X	X	X	X	X	X	X	
050 06 02 08		**Movement of fronts and pressure systems, life cycle**								
(01)		Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression.	X	X	X	X	X	X	X	
(02)		State the rules for predicting the direction and the speed of movement of fronts.	X	X	X	X	X	X	X	
(03)		State the difference in the speed of movement between cold and warm fronts.	X	X	X	X	X	X	X	
(04)		State the rules for predicting the direction and the speed of movement of frontal depressions.	X	X	X	X	X	X	X	
(05)		Describe, with a sketch if required, the genesis, development and life cycle of a	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		frontal depression with associated cloud and rain belts								
050 06 02 09		**Changes of meteorological elements at a frontal wave**								
(01)		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	X	
050 07 00 00		**PRESSURE SYSTEMS**								
050 07 01 00		**The principal pressure areas**								
050 07 01 01		**Location of the principal**								
(01)		Identify or indicate on a map the principal global high-pressure and low-pressure area in January and July.	X		X	X				
(02)		Explain how these pressure areas are formed.	X		X	X				
(03)		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 subsidence**								
(01)		List the different types of anticyclones.	X	X	X	X	X	X	X	
(02)		Describe the effect of high-level convergence in producing areas of high pressure at ground level.	X	X	X	X	X	X	X	
(03)		Describe air-mass subsidence, its effect on the environmental lapse rate, and the associated weather.	X	X	X	X	X	X	X	
(04)		Describe the formation of warm and cold anticyclones.	X	X	X	X	X	X	X	
(05)		Describe the formation of ridges.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Describe the properties of and the weather associated with warm and cold anticyclones.	X	X	X	X	X	X	X	
(07)		Describe the properties of and the weather associated with ridges.	X	X	X	X	X	X	X	
(08)		Describe the blocking anticyclone and its effects.	X	X	X	X	X	X	X	
050 07 03 00		**Non-frontal depression**								
050 07 03 01		**Thermal, orographic, polar and secondary depressions; troughs**								
(01)		Describe the effect of high-level divergence in producing areas of low pressure at ground level.	X	X	X	X	X	X	X	
(02)		Describe the formation and properties of thermal, orographic (lee lows), polar and secondary depressions.	X	X	X	X	X	X	X	
(03)		Describe the formation, the properties and the associated weather at troughs.	X	X	X	X	X	X	X	
050 07 04 00		**Tropical revolving storms**								
050 07 04 01		**Characteristics of tropical revolving storms**								
(01)		State the conditions necessary for the formation of tropical revolving storms.	X	X	X	X	X			
(02)		State how a tropical revolving storm generally moves in its area of occurrence.	X	X	X	X	X			
(03)		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	X	X			
(04)		Describe the meteorological conditions in and near a tropical revolving storm.	X	X	X	X	X			
(05)		State the approximate dimensions of a tropical revolving storm.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		State that the movement of a tropical revolving storm can only rarely be forecast exactly, and that utmost care is necessary near a tropical revolving storm.	X	X	X	X	X			
050 07 04 02		**Origins and local names, location and period of occurrence**								
(01)		List the areas of origin and occurrence of tropical revolving storms, and their specified names (hurricane, typhoon, tropical cyclone).	X	X	X	X	X			
(02)		State the expected times of occurrence of tropical revolving storms in each of the source areas, and their approximate frequency.	X	X	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**								
(01)	X	Describe the general tropospheric and low stratospheric circulation. (Refer to Subject 050 02 03 01)	X	X	X	X	X			
050 08 01 02		**Climatic classification**								
(01)		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	X	X			
(02)		Explain how the seasonal movement of the sun generates the transitional climate zones.	X	X	X	X	X			
(03)		State the typical locations of each major climatic zone.	X		X	X				
050 08 02 00		**Tropical climatology**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 08 02 01		**Cause and development of tropical showers and thunderstorms: humidity, temperature, tropopause**								
(01)		State the conditions necessary for the formation of tropical showers and thunderstorms (mesoscale convective complex, cloud clusters).	X	X	X	X	X			
(02)		Describe the characteristics of tropical squall lines.	X	X	X	X	X			
(03)		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	X	X			
(04)		State the typical figures for tropical surface air temperatures and humidities, and for heights of the zero-degree isotherm.	X	X	X	X	X			
050 08 02 02		**Seasonal variations of weather and wind, typical synoptic situations**								
(01)		Indicate on a map the trade winds (tropical easterlies) and describe the associated weather.	X	X	X	X	X			
(02)		Indicate on a map the doldrums and describe the associated weather.	X	X	X	X	X			
(03)		Indicate on a sketch the latitudes of subtropical high (horse latitudes) and describe the associated weather.	X	X	X	X	X			
(04)		Indicate on a map the major monsoon wind.	X	X	X	X	X			
050 08 02 03		**Intertropical Convergence Zone (ITCZ), weather in the ITCZ, general seasonal movement**								
(01)		Identify or indicate on a map the positions of the ITCZ in January and July.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the seasonal movement of the ITCZ.	X	X						
(03)		Describe the weather and winds at the ITCZ.	X	X						
(04)		Explain the flight hazards associated with the ITCZ.	X	X						
050 08 02 04		**Monsoon, sandstorms, cold-air outbreaks**								
(01)		Define in general the term ‘monsoon’ and give a general overview of regions of occurrence.	X	X	X	X	X			
(02)		Describe the major monsoon conditions. (Refer to Subject 050 08 02 02)	X	X	X	X	X			
(03)		Explain how trade winds change character after a long track and become monsoon winds.	X	X	X	X	X			
(04)		Explain the weather and the flight hazards associated with a monsoon.	X	X	X	X	X			
(05)		Explain the formation of the SW/NE monsoon over West Africa and describe the weather, stressing the seasonal differences.	X	X	X	X	X			
(06)		Explain the formation of the SW/NE monsoon over India and describe the weather, stressing the seasonal differences.	X	X	X	X	X			
(07)		Explain the formation of the monsoon over the Far East and northern Australia and describe the weather, stressing the seasonal differences.	X	X	X	X	X			
(08)		Describe the formation and properties of sandstorms.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		Indicate when and where outbreaks of cold polar air can enter subtropical weather systems.	X	X	X	X	X			
(10)		Name well-known examples of polar-air outbreaks (Blizzard, Pampero).	X	X	X	X	X			
050 08 02 05		**Easterly waves**								
(01)		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)**								
(01)		Identify on a weather chart the typical westerly situation with travelling polar front waves.	X	X				X	X	
050 08 03 02		**High-pressure area**								
(01)		Describe the high-pressure zones with the associated weather.								
(02)		Identify on a weather chart the high-pressure regions.								
050 08 03 03		**Intentionally left blank**								
050 08 03 04		**Cold-air drop**								
(01)		Define ‘cold-air drop’.	X	X	X	X	X	X	X	
(02)		Describe the formation of a cold-air drop.	X	X	X	X	X	X	X	
(03)		Identify cold-air drops on weather charts.	X	X	X	X	X	X	X	
(04)		Explain the problems and dangers of cold-air drops for aviation.	X	X	X	X	X	X	X	
050 08 04 00		**Local winds and associated weather**								
050 08 04 01		**Foehn, Mistral, Bora**								
(01)		Describe the mechanism for the development of Foehn winds (including Chinook).	X	X	X	X	X	X		
(02)		Describe the weather associated with Foehn winds.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe the formation of, the characteristics of, and the weather associated with Mistral and Bora.	X	X	X	X	X	X		
050 08 04 02		**Harmattan**								
(01)		Describe the Harmattan wind and the associated visibility problems as an example of local winds affecting visibility.	X	X	X	X	X	X		
050 09 00 00		**FLIGHT HAZARDS**								
050 09 01 00		**Icing**								
050 09 01 01		**Conditions for ice accretion**								
(01)		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	X	
(02)		Explain the general weather conditions under which ice accretion occurs in a venturi carburettor.	X	X	X	X	X	X	X	
(03)		Explain the general weather conditions under which ice accretion occurs on airframe.	X	X	X	X	X	X	X	
(04)		Explain the formation of supercooled water in clouds, rain and drizzle. (Refer to Subject 050 03 02 01)	X	X	X	X	X	X	X	
(05)		Explain qualitatively the relationship between the air temperature and the amount of supercooled water.	X	X	X	X	X	X	X	
(06)		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	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation.	X	X	X	X	X	X	X	
(08)		Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, and outside clouds and precipitation.	X	X	X	X	X	X	X	
(09)		Explain the influence of fuel temperature, radiative cooling of the aircraft surface and temperature of the aircraft surface (e.g. from previous flight) on ice formation.								
(10)		Describe the different factors that influence 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	X	
(11)		Explain the effects of topography on icing.	X	X	X	X	X	X	X	
(12)		Explain the higher concentration of water drops in stratiform orographic clouds.	X	X	X	X	X	X	X	
050 09 01 02		**Types of ice accretion**								
(01)	X	Define ‘clear ice’.	X	X	X	X	X	X	X	
(02)		Describe the conditions for the formation of clear ice.	X	X	X	X	X	X	X	
(03)		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	X	
(04)		Describe the aspects of clear ice: appearance, weight, solidity.	X	X	X	X	X	X	X	
(05)		Define ‘rime ice’.	X	X	X	X	X	X	X	
(06)		Describe the conditions for the formation of rime ice.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Describe the aspects of rime ice: appearance, weight, solidity.	X	X	X	X	X	X	X	
(08)		Define 'mixed ice'.	X	X	X	X	X	X	X	
(09)		Describe the conditions for the formation of mixed ice.	X	X	X	X	X	X	X	
(10)		Describe the aspects of mixed ice: appearance, weight, solidity.	X	X	X	X	X	X	X	
(11)		Describe the possible process of ice formation in snow conditions.	X	X	X	X	X	X	X	
(12)		Define 'hoar frost'.	X	X	X	X	X	X	X	
(13)		Describe the conditions for the formation of hoar frost.	X	X	X	X	X	X	X	
(14)		Describe the aspects of hoar frost: appearance, solidity.	X	X	X	X	X	X	X	
050 09 01 03		**Hazards of ice accretion, avoidance**								
(01)		State the ICAO qualifying terms for the intensity of icing. **Source: ICAO Doc 4444 'Procedures for Air Navigation Services — Air Traffic Management'**	X	X	X	X	X	X	X	
(02)		Describe, in general, the hazards of icing.	X	X	X	X	X	X	X	
(03)		Assess the dangers of the different types of ice accretion.	X	X	X	X	X	X	X	
(04)		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	X	
(05)		Indicate the possibilities of avoiding dangerous zones of icing: — in the flight planning: weather briefing, selection of track and altitude; — during flight: recognition of the dangerous zones, selection of appropriate track and altitude.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 09 01 04		**Ice crystal icing**								
(01)		Describe ice crystal icing.	X	X	X	X	X	X	X	
(02)		Describe the atmospheric processes leading to high ice crystal concentration. Define the variable ice water content (IWC).	X	X	X	X	X	X	X	
(03)		Identify weather situations and their relevant areas where high concentrations of ice crystals are likely to occur.	X	X	X	X	X	X	X	
(04)		Name, in general, the flight hazards associated with high concentrations of ice crystals.	X	X	X	X	X	X	X	
(05)		Explain how a pilot may possibly avoid areas with a high concentration of ice crystals.	X	X	X	X	X	X	X	
050 09 02 00		**Turbulence**								
050 09 02 01		**Effects on flight, avoidance**								
(01)		State the ICAO qualifying terms for the intensity of turbulence. **Source: ICAO Doc 4444 'Procedures for Air Navigation Services — Air Traffic Management'**	X	X	X	X	X	X	X	
(02)		Describe the effects of turbulence on an aircraft in flight.	X	X	X	X	X	X	X	
(03)		Indicate the possibilities of avoiding turbulence: — in the flight planning: weather briefing, selection of track and altitude; — during flight: selection of appropriate track and altitude.	X	X	X	X	X	X	X	
(04)		Describe atmospheric turbulence and distinguish between turbulence, gustiness and wind shear.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe that forecasts of turbulence are not very reliable and state that pilot reports of turbulence are very valuable as they help others to prepare for or avoid turbulence.	X	X	X	X	X	X	X	
050 09 02 02		**Clear-air turbulence (CAT): effects on flight, avoidance**								
(01)		Describe the effects of CAT on flight. (Refer to Subject 050 02 06 03)	X	X	X	X	X			
(02)		Indicate the possibilities of avoiding CAT in flight: in the flight planning: weather briefing, selection of track and altitude; during flight: selection of appropriate track and altitude.	X	X	X	X	X			
050 09 03 00		**Wind shear**								
050 09 03 01		**Definition of wind shear**								
(01)		Define 'wind shear' (vertical and horizontal).	X	X	X	X	X	X	X	
(02)		Define 'low-level wind shear'.	X	X	X	X	X	X	X	
050 09 03 02		**Weather conditions for wind shear**								
(01)		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	X	
050 09 03 03		**Effects on flight, avoidance**								
(01)		Describe the effects of wind shear on flight.	X	X	X	X	X	X	X	
(02)		Indicate the possibilities of avoiding wind shear in flight: — in the flight planning; — during flight.	X	X	X	X	X	X	X	
050 09 04 00		**Thunderstorms**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 09 04 01		**Conditions for and process of development, forecast, location, type specification**								
(01)		Name the cloud types which indicate the development of thunderstorms.	X	X	X	X	X	X	X	
(02)		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	X	
050 09 04 02		**Structure of thunderstorms, life cycle**								
(01)		Assess the average duration of thunderstorms and their different stages.	X	X	X	X	X	X	X	
(02)		Describe a supercell storm: initial, supercell, tornado and dissipating stage.	X	X	X	X	X	X	X	
(03)		Summarise the flight hazards associated with a fully developed thunderstorm.	X	X	X	X	X	X	X	
(04)		Indicate on a sketch the most dangerous zones in and around a single-cell and a multi-cell thunderstorm.	X	X	X	X	X	X	X	
050 09 04 03		**Electrical discharges**								
(01)		Describe the basic outline of the electric field in the atmosphere.	X	X	X	X	X	X	X	
(02)		Describe types of lightning, i.e. ground stroke, intra-cloud lightning, cloud-to-cloud lightning, upward lightning.	X	X	X	X	X	X	X	
(03)		Describe and assess the ‘St. Elmo’s fire’ weather phenomenon.	X	X	X	X	X	X	X	
(04)		Describe the development of lightning discharges.	X	X	X	X	X	X	X	
(05)		Describe the effect of lightning strike on aircraft and flight execution.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
050 09 04 04		**Development and effects of downbursts**								
(01)		Define the term 'downburst'.	X	X	X	X	X	X	X	
(02)		Distinguish between macroburst and microburst.	X	X	X	X	X	X	X	
(03)		State the weather situations leading to the formation of downbursts.	X	X	X	X	X	X	X	
(04)		Describe the process of development of a downburst.	X	X	X	X	X	X	X	
(05)		Give the typical duration of a downburst.	X	X	X	X	X	X	X	
(06)		Describe the effects of downbursts.	X	X	X	X	X	X	X	
050 09 04 05		**Thunderstorm avoidance**								
(01)		Explain how the pilot can anticipate each type of thunderstorm: through 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 Subject 050 10 01 04), use of a lightning detector (stormscope). (Refer to Subject 050 10 01 04), use of the stormscope (lightning detector).	X	X	X	X	X	X	X	
(02)		Describe practical examples of flight techniques used to avoid the hazards of thunderstorms.	X	X	X	X	X	X	X	
050 09 05 00		**Tornadoes**								
050 09 05 01		**Properties and occurrence**								
(01)		Define 'tornado'.	X	X	X	X	X	X	X	
(02)		Describe the formation of a tornado.	X	X	X	X	X			
(03)		Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement, and wind speed.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Compare the occurrence of tornadoes in Europe with the occurrence in other locations, especially in the United States of America.	X	X	X	X	X			
(05)		Compare the dimensions and properties of tornadoes and dust devils.	X	X	X	X	X			
050 09 06 00		**Inversions**								
050 09 06 01		**Influence on aircraft performance**								
(01)		Compare the flight hazards during take-off and approach associated with a strong inversion alone and with a strong inversion combined with marked wind shear.	X	X	X	X	X	X	X	
050 09 07 00		**Stratospheric conditions**								
050 09 07 01		**Influence on aircraft performance**								
(01)		Summarise the advantages of stratospheric flights.	X	X	X	X	X			
(02)		List the influences of the phenomena associated with the lower stratosphere (wind, temperature, air density, turbulence).	X	X	X	X	X			
050 09 08 00		**Hazards in mountainous areas**								
050 09 08 01		**Influence of terrain on clouds and precipitation, frontal passage**								
(01)		Describe the influence of mountainous area on a frontal passage.	X	X	X	X	X	X	X	
050 09 08 02		**Vertical movements, mountain waves, wind shear, turbulence, ice accretion**								
(01)		Describe the vertical movements, wind shear and turbulence that are typical of mountain areas.	X	X	X	X	X	X	X	
(02)		Indicate on a sketch of a chain of mountains the turbulent zones (mountain waves, rotors).	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the influence of relief on ice accretion.	X	X	X	X	X	X	X	
050 09 08 03		**Development and effect of valley inversions**								
(01)		Describe the formation of a valley inversion due to katabatic winds.	X	X	X	X	X	X	X	
(02)		Describe the valley inversion formed by warm winds aloft.	X	X	X	X	X	X	X	
(03)		Describe the effects of a valley inversion for an aircraft in flight.	X	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**								
(01)		Describe the reduction of visibility caused by precipitation: drizzle, rain, snow.	X	X	X	X	X	X	X	
(02)		Describe the reduction of visibility caused by obscurations: — fog, mist, haze, smoke, volcanic ash.	X	X	X	X	X	X	X	
(03)		Describe the reduction of visibility caused by obscurations: — sand (SA), dust (DU).	X		X	X				
(04)		Describe the differences between ground and flight visibility, and slant and vertical visibility when an aircraft is above or within a layer of haze or fog.	X	X	X	X	X	X	X	
050 09 09 02		**Reduction of visibility caused by other phenomena**								
(01)		Describe the reduction of visibility caused by low drifting and blowing snow.	X	X	X	X	X	X	X	
(02)		Describe the reduction of visibility caused by low drifting and blowing dust and sand.	X	X	X	X	X			
(03)		Describe the reduction of visibility caused by dust storm (DS) and sandstorm (SS).	X	X	X	X	X			
(04)		Describe the reduction of visibility caused by icing (windshield).	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Describe the reduction of visibility caused by the reflection of the sun's rays from the top of the layers of haze, fog and clouds.	X	X	X	X	X	X	X	
050 10 00 00		**METEOROLOGICAL INFORMATION**								
050 10 01 00		**Observation**								
050 10 01 01		**Surface observations**								
(01)		Define 'gusts', as given in METARs.	X	X	X	X	X	X	X	
(02)		Distinguish wind given in METARs and wind given by the control tower for take-off and landing.	X	X	X	X	X	X	X	
(03)		Define 'visibility'.	X	X	X	X	X	X	X	
(04)		Describe the meteorological measurement of visibility.	X	X	X	X	X	X	X	
(05)		Define 'prevailing visibility'.	X	X	X	X	X	X	X	
(06)		Define 'ground visibility'.	X	X	X	X	X	X	X	
(07)		List the units used for visibility (m, km, statute mile).	X	X	X	X	X	X	X	
(08)		Define 'runway visual range'.	X	X	X	X	X	X	X	
(09)		Describe the meteorological measurement of runway visual range.	X	X	X	X	X	X	X	
(10)		Indicate where the transmissometers/forward-scatter meters are placed on the aerodrome	X	X	X	X	X	X	X	
(11)		List the units used for runway visual range (m, ft).	X	X	X	X	X	X	X	
(12)		List the different possibilities to transmit information to pilots about runway visual range.	X	X	X	X	X	X	X	
(13)		Compare ground visibility, prevailing visibility, and runway visual range.	X	X	X	X	X	X	X	
(14)		Indicate the means of observation of present weather.	X	X	X	X	X	X		

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
(15)		Indicate the means of observing clouds for the purpose of recording: type, amount, height of base (ceilometers), and top.	X	X	X	X	X	X		
(16)		State the clouds which are indicated in METAR, TAF and SIGMET.	X	X	X	X	X	X	X	
(17)		Define 'oktas'.	X	X	X	X	X	X	X	
(18)		Define 'cloud base'.	X	X	X	X	X	X	X	
(19)		Define 'ceiling'.	X	X	X	X	X	X	X	
(20)		Name the unit and the reference level used for information about cloud base (ft).	X	X	X	X	X	X	X	
(21)		Define 'vertical visibility'.	X	X	X	X	X	X	X	
(22)		Explain briefly how and when vertical visibility is measured.	X	X	X	X	X	X	X	
(23)		Name the units used for vertical visibility (ft, m).	X	X	X	X	X	X	X	
(24)		Indicate the means of observation of air temperature (thermometer).	X	X	X	X	X	X	X	
(25)		Name the units of relative humidity (%) and dew-point temperature (Celsius, Fahrenheit).	X	X	X	X	X	X		
050 10 01 02		**Radiosonde observations**								
(01)		Describe the principle of radiosondes.	X	X	X	X	X	X		
(02)	X	Describe and interpret the sounding by radiosonde given on a simplified temperature–pressure (T–P) diagram.	X	X	X	X	X	X		
050 10 01 03		**Satellite observations**								
(01)		Describe the basic outlines of satellite observations.	X	X	X	X	X	X	X	
(02)		Name the main uses of satellite pictures in aviation meteorology.	X	X	X	X	X	X	X	
(03)		Describe the different types of satellite imagery.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Interpret qualitatively the satellite pictures in order to get useful information for flights: — location of clouds (distinguish between stratiform and cumuliform clouds).	X	X	X	X	X	X	X	
(05)		Interpret qualitatively the satellite pictures in order to get useful information for flights: — location of fronts.	X	X	X	X	X	X	X	
(06)		Interpret qualitatively the satellite pictures in order to get useful information for flights using atmospheric motion vector images to locate jet streams.	X							
050 10 01 04		**Weather radar observations** (Refer to Subject 050 09 04 05)								
(01)		Describe the basic principle and the type of information given by a ground weather radar.	X	X	X	X	X	X		
(02)		Interpret ground weather radar images.	X	X	X	X	X	X	X	
(03)		Describe the basic principle and the type of information given by airborne weather radar.	X	X	X	X	X	X	X	
(04)		Describe the limits and the errors of airborne weather radar information.	X	X	X	X	X	X	X	
(05)		Interpret typical airborne weather radar images.	X	X	X	X	X	X	X	
050 10 01 05		**Aircraft observations and reporting**								
(01)		Describe routine air-report and special air-report (ARS).	X	X	X	X	X	X	X	
(02)		State the obligation of a pilot to prepare air-reports.	X	X	X	X	X	X	X	
(03)		Name the weather phenomena to be stated in an ARS.	X	X	X	X	X	X	X	
050 10 02 00		**Weather charts**								
050 10 02 01		**Significant weather charts**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Decode and interpret significant weather charts (low, medium and high level).	X	X	X	X	X	X	X	
(02)		Describe from a significant weather chart the flight conditions at designated locations or along a defined flight route at a given FL.	X	X	X	X	X	X	X	
050 10 02 02		**Surface charts**								
(01)		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	X	
(02)		Determine from surface weather charts the wind direction and speed.	X	X	X	X	X	X	X	
050 10 02 03		**Upper-air charts**								
(01)		Define ‘constant-pressure chart’.	X	X	X					
(02)		Define ‘isohypse (contour line)’. (Refer to Subject 050 01 03 02)	X	X	X					
(03)		Define ‘isotherm’.	X	X	X					
(04)		Define ‘isotach’.	X	X	X					
(05)		Describe forecast upper-wind and temperature charts.	X	X	X					
(06)		For designated locations 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					
050 10 02 04		**Gridded forecast products**								
(01)		State that numerical weather prediction uses a 3D grid of weather data, consisting	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		of horizontal data (latitude-longitude) and vertical data (height or pressure).								
(02)		Explain that world area forecast centres prepare global sets of gridded forecasts for flight planning purposes (upper wind, temperature, humidity).	X	X	X	X	X			
(03)		State that the WAFCs also produce gridded datasets for Flight Level and temperature of the tropopause, direction and speed of maximum wind, cumulonimbus clouds, icing and turbulence.	X	X	X	X	X			
(04)		Explain that the data on CB and turbulence can be used in the visualization of flight hazards.	X	X	X	X	X			
(05)		Explain that the gridded forecasts can be merged in information processing systems with data relayed from aircraft or pilot reports, e.g. of turbulence, to provide improved situation awareness.	X	X	X	X	X			
050 10 03 00		**Information for flight planning**								
050 10 03 01		**Aviation weather messages**								
(01)		Describe, decode and interpret the following aviation weather messages (given in written or graphical format): METAR, aerodrome special meteorological report (SPECI), trend forecast (TREND), TAF, information concerning en-route weather phenomena which may affect the safety of aircraft operations (SIGMET), information concerning en-route weather phenomena which may affect the safety of low-level aircraft operations (AIRMET), area	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		forecast for low-level flights (GAMET), ARS, volcanic ash advisory information.								
(02)		Describe, decode and interpret the tropical cyclone advisory information in written and graphical form.	X	X	X	X	X			
(03)		Describe the general meaning of MET REPORT and SPECIAL REPORT.	X	X	X	X	X	X	X	
(04)		List, in general, the cases when a SIGMET and an AIRMET are issued.	X	X	X	X	X	X	X	
(05)		Describe, decode (by using a code table) and interpret the following messages: runway state message (as written in a METAR). Remark: For runway state message, refer to ICAO Doc 7754 'Air Navigation Plan — European Region'.	X	X	X	X	X	X	X	
050 10 03 02		**Meteorological broadcasts for aviation**								
(01)		Describe the meteorological content of broadcasts for aviation: — meteorological information for aircraft in flight (VOLMET); — automatic terminal information service (ATIS).	X	X	X	X	X	X	X	
(02)		Describe the meteorological content of broadcasts for aviation: — HF-VOLMET.	X	X	X	X	X			
050 10 03 02		**Use of meteorological documents**								
(01)		Describe meteorological briefing and advice.	X	X	X	X	X	X	X	
(02)		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	X	
(03)		List the meteorological information that a flight crew can receive from flight	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		information services during flight and apply the content of this information for the continuation of the flight.								
050 10 03 04		**Meteorological warnings**								
(01)		Describe and interpret aerodrome warnings and wind-shear warnings and alerts.	X	X	X	X	X	X	X	
050 10 04 00		**Meteorological services**								
050 10 04 01		**World area forecast system and meteorological offices**								
(01)	X	Name the world area forecast centres (WAFCs) as the provider for upper-air forecasts: WAFCs prepare upper-air gridded forecasts of upper winds; upper-air temperature and humidity; direction, speed and flight level of maximum wind; flight level and temperature of tropopause, areas of cumulonimbus clouds, icing, clear-air and in-cloud turbulence, and geopotential altitude of flight levels.	X	X	X	X	X	X	X	
(02)	X	Name the meteorological (MET) offices as the provider for aerodrome forecasts and briefing documents.	X	X	X	X	X	X	X	
(03)	X	Name the meteorological watch offices (MWOs) as the provider for SIGMET and AIRMET information.	X	X	X	X	X	X	X	
(04)	X	Name the aeronautical meteorological stations as the provider for METAR and MET reports.	X	X	X	X	X	X		
(05)	X	Name the volcanic ash advisory centres (VAACs) as the provider for forecasts of volcanic ash clouds.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)	X	Name the tropical cyclone advisory centres (TCACs) as the provider for forecasts of tropical cyclones.	X		X	X				
050 10 04 02		**International organisations**								
(01)	X	Describe briefly the following organisations and their chief activities in relation to weather for aviation: — International Civil Aviation Organization (ICAO) (Refer to Subject 010 'Air Law'); — World Meteorological Organization (WMO).	X	X	X	X	X	X		

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SUBJECT 061 – NAVIGATION – GENERAL NAVIGATION

Mental dead reckoning (MDR)

Where the term 'mental dead reckoning' (MDR) is used within a Learning Objective (LO), the applicable technique which will be used for the European Central Question Bank (ECQB) questions is based on the methods shown below.

Examination questions will state that an MDR technique is required to produce the solution. If other techniques (e.g. trigonometry) are used to determine the answer, then the determined answer may be incorrect.

MDR crosswind component (XWC)

The XWC can be calculated using a 'clock code rule', where each 15° of wind angle is represented by 1/4 of an hour — meaning 1/4 the wind strength. The XWC can be estimated using the values from the table below:

Wind angle	15°	30°	45°	60°
% of wind speed	25	50	75	100

(Wind angle (WA) is the angle between the wind vector and the track/runway direction to the nearest 10°)

Example:

RWY 04 and surface wind from tower is 085°/20 kt. What is the XWC?

WA = 45°

XWC = (0.75) × 20

= 15 kt

MDR headwind component (HWC)/tailwind component (TWC)

The H/TWC can be estimated using the values from the following table:

90° - Wind angle	10°	20°	30°	40°	50°	60°
% of wind speed	0.2	0.3	0.5	0.6	0.8	0.9

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To assist recall, an aid is shown below:

90° - Wind angle	10°	20°	30°	40°	50°	60°
Aid	1	1	2	2	3	3
% of wind speed	0.2	0.3	0.5	0.6	0.8	0.9

Example:

RWY 04 and surface wind from tower is 080°/20 kt. What is the HWC?

WA = 40°

90° – WA = 50°

HWC = (0.8) × 20

= 16 kt

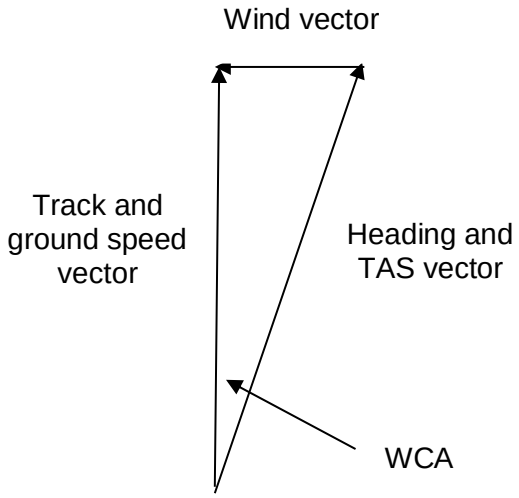
Alternately, for XWC and TWC/HWC MDR calculations, the values in the following table can be used, assuming XWC = wind velocity × sine WA and TWC/HWC = wind velocity × cosine WA

Wind angle	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
Sine	0	0.2	0.3	0.5	0.6	0.8	0.9	0.9	1	1
Aid	0	1	1	2	2	3	3	2	2	1

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MDR triangle of velocities (TOV)

Heading is determined by calculating the XWC as previously described, then applying the 1:60 rule to the TOV as follows:



This MDR technique works for the relatively small WCAs which are typical for medium to high TAS values (the ground speed (GS) therefore can be assumed to be equal to the TAS for application of the 1:60 rule).

Example 1:

Planned track = 070° (T)

TAS = 400 kt

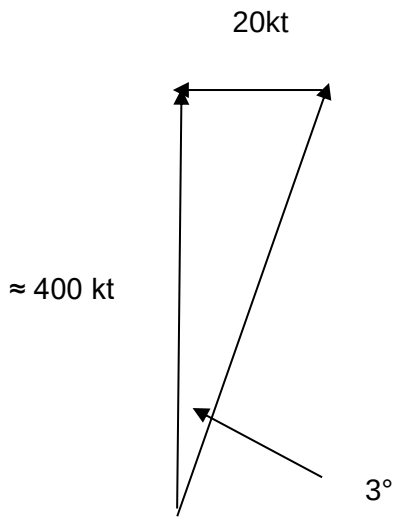
WV = 100° (T)/40 kt

WA = 30°

XWC = (0.5) × 40

= 20 kt

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Heading required = 073° (T)

GS is determined by using the headwind/tailwind example previously explained.

WA = 30°

90° – 30° = 60°

HWC = (0.9) × 40

= 36 kt

GS = 400 – 36 = 364 kt

Example 2:

Planned track = 327° (T)

TAS = 240 kt

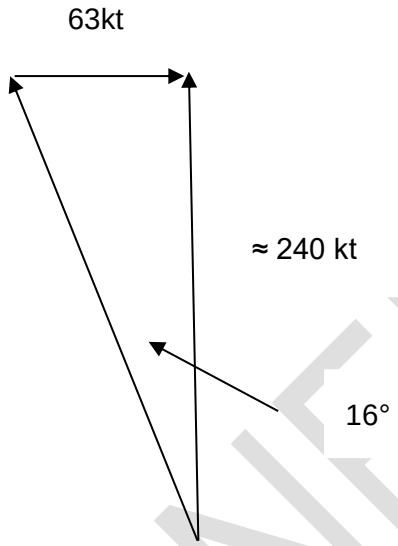
WV = 210° (T)/70 kt

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WA = 60°

XWC = (0.9) × 7

= 63 kt



WCA = 16°

Heading required = 311° (T)

GS is determined by using the headwind/tailwind example previously explained.

WA = 60°

90° – 60° = 30°

TWC = (0.5) × 70

= 35 kt

GS = 240 + 35 = 275 kt

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VFR navigation (061 02 00 00)

The techniques referred to within the LOs are based on the methods as described below.

Mental dead reckoning (MDR) off-track corrections

Based on the 1:60 rule 1 NM of cross-track error (XTE) for every 60 NM along track from waypoint = 1° of track error angle (TKE).

1 NM of XTE for every 60 NM along track to waypoint = 1° of closing angle (CA).

Change of heading required to regain track in same distance as covered from waypoint to position off track = 2 × TKE.

Change of heading required to reach next waypoint from position off track = TKE + CA.

Example 1:

Planned heading is 162° (T), and after 40 NM along track the aircraft position is fixed 2 NM right of planned track. What heading is required to regain track in approximately the same time as has taken to the fix position?

TKE = 3°

Heading required = 156° (T)

Example 2:

Planned heading is 317° (T), and after 22 NM along track the aircraft position is fixed 3.5 NM left of planned track. What heading is required to fly direct to the next waypoint which is another 45 NM down track?

TKE = 10°, CA = 5°

Heading required = 332° (T)

Mental dead reckoning (MDR) estimated time of arrival (ETA) calculations

Round the GS to the nearest NM/min, and then make the same percentage adjustment for the distance.

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Example:

Distance to go = 42 NM

GS = 132 kt

GS rounded to 120 kt = 2 NM/min

Percentage change = 10 %

Distance = 42 – 10 % = 38 NM

Time = 38 / 2 = 19 min

Unsure-of-position procedure

As soon as the position of the aircraft is in doubt:

1. note the time;

2. communicate if in contact with an air traffic control (ATC) unit to request assistance;

3. consider using any radio-navigation aids that may be available to give position information (do not become distracted from flying the aircraft safely);

4. if short of fuel or near controlled airspace, and not in contact with ATC, set 121.5 MHz and make a PAN call;

5. if that is not necessary, check the directional indicator (DI) and compass are still synchronised and continue to fly straight and level and on route plan heading;

6. estimate the distance travelled since the last known position;

7. compare the ground with your estimated position on the map (look at the terrain for hills and valleys or line features such as a motorway, railway, river or coastline);

8. once the position has been re-established, keep checking the heading (and look out for other aircraft) and continue the flight by updating the estimated position regularly while looking for unique features such as a lake, wood, built-up area, mast, or a combination of roads, rivers and railways.

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Procedure when lost

If the unsure-of-position procedure does not resolve the problem:

1. inform someone — call first on the working frequency and state the word 'LOST';

2. if there is no contact on that frequency or there is no frequency selected, change to 121.5 MHz and make a PAN call; select 7700 with ALT on the transponder if fitted.

In all cases: maintain visual meteorological conditions (VMC), note the fuel state, and try to identify an area suitable for a precautionary landing. Consider the 'HELP ME' mnemonic:

H. High ground/obstructions — are there any nearby?

E. Entering controlled airspace — is that a possibility?

L. Limited experience, low time or student pilot — let someone know.

P. PAN call in good time — don't leave it too late.

M. MET conditions — is the weather deteriorating?

E. Endurance — is fuel getting low?

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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 Earth**								
061 01 01 01		**Form**								
(01)	X	State that the geoid is an irregular shape based on the surface of the oceans influenced only by gravity and centrifugal force.	X	X	X	X	X			
(02)	X	State that a number of different ellipsoids are used to describe the shape of the Earth for mapping but that WGS-84 is the reference ellipsoid required for geographical coordinates.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State that the circumference of the Earth is approximately 40 000 km or approximately 21 600 NM.	X	X	X	X	X			
061 01 01 02		**Earth rotation**								
(01)	X	Describe the rotation of the Earth around its own spin axis and the plane of the ecliptic (including the relationship of the spin axis to the plane of the ecliptic).	X	X	X	X	X			
(02)		Explain the effect that the inclination of the Earth's spin axis has on insolation and duration of daylight.	X	X	X	X	X			
061 01 02 00		**Position**								
061 01 02 01		**Position reference system**								
(01)	X	State that geodetic latitude and longitude is used to define a position on the WGS-84 ellipsoid.	X	X	X	X	X			
(02)		Define geographic (geodetic) latitude and parallels of latitude.	X	X	X	X	X			
(03)		Calculate the difference in latitude between any two given positions.	X	X	X	X	X			
(04)		Define geographic (geodetic) longitude and meridians.	X	X	X	X	X			
(05)		Calculate the difference in longitude between any two given positions.	X	X	X	X	X			
061 01 03 00		**Direction**								
061 01 03 01		**Datums**								
(01)	X	Define 'true north' (TN).	X	X	X	X	X			
(02)		Measure a true direction on any given aeronautical chart.	X	X	X	X	X			
(03)	X	Define 'magnetic north' (MN).	X	X	X	X	X			
(04)		Define and apply variation.	X	X	X	X	X			
(05)		Explain changes of variation with time and position.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)	X	Define ‘compass north’ (CN).	X	X	X	X	X			
(07)		Apply deviation.	X	X	X	X	X			
060 01 03 02		**Track and heading**								
(01)		Calculate XWC by: — trigonometry; and — MDR.								
(02)		Explain and apply the concepts of drift and WCA.	X	X	X	X	X			
(03)		Calculate the actual track with appropriate data of heading and drift.	X	X	X	X	X			
(04)		Calculate TKE with appropriate data of WCA and drift.	X	X	X	X	X			
(05)		Calculate the heading change at an off-course fix to directly reach the next waypoint using the 1:60 rule.	X	X	X	X	X			
(06)		Calculate the average drift angle based upon an off-course fix observation.	X	X	X	X	X			
061 01 04 00		**Distance**								
061 01 04 01		**WGS-84 ellipsoid**								
(01)	X	State that 1 NM is equal to 1 852 km, which is the average distance of 1' of latitude change on the WGS-84 ellipsoid.	X	X	X	X	X			
(02)		State that 1' of longitude change at the equator on the WGS-84 ellipsoid is approximately equal to 1 NM.	X	X	X	X	X			
061 01 04 02		**Units**								
(01)		Convert between units of distance (nautical mile (NM), kilometre (km), statute mile (SM), feet (ft), inches (in)).	X	X	X	X	X			
061 01 04 03		**Graticule distances**								
(01)		Calculate the distance between positions on the same meridian, on opposite (antipodal) meridians, on the same parallel of latitude, and calculate new	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		latitude/longitude when given distances north-south and east-west.								
061 01 04 04		**Air mile**								
(01)		Evaluate the effect of wind and altitude on air distance.	X	X	X	X	X			
(02)		Convert between ground distance (NM) and air distance (NAM) using the formula: NAM = NM × TAS/GS.	X	X	X	X	X			
061 01 05 00		**Speed**								
061 01 05 01		**True airspeed (TAS)**								
(01)		Calculate TAS from CAS, and CAS from TAS by: — mechanical computer; and — rule of thumb (2 % per 1 000 ft).	X	X	X	X	X			
061 01 05 02		**Mach number (M)**								
(01)		Calculate TAS from M, and M from TAS.	X	X						
061 01 05 03		**CAS/TAS/M relationship**								
(01)		Deduce the CAS, TAS and M relationship in climb/descent/cruise (flying at constant CAS or M).	X	X						
(02)		Deduce CAS and TAS in climb/descent/cruise (flying at constant CAS).			X	X	X			
061 01 05 04		**Ground speed (GS)**								
(01)		Calculate headwind component (HWC) and tailwind component (TWC) by: — trigonometry; and — MDR.	X	X	X	X	X			
(02)		Apply HWC and TWC to determine GS from TAS and vice versa.	X	X	X	X	X			
(03)	X	Explain the relationship between GS and TAS with increasing WCA.	X	X	X	X				
(04)		Calculate GS with:	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— mechanical computer (TOV solution); and — MDR (given track, TAS and WV).								
(05)		Perform GS, distance and time calculations.	X	X	X	X	X			
(06)		Calculate revised GS to reach a waypoint at a specific time.	X	X	X	X	X			
(07)		Calculate the average GS based on two observed fixes.	X	X	X	X	X			
061 01 05 05		**Flight log**								
(01)		Enter revised navigational en-route data, for the legs concerned, into the flight plan (e.g. updated wind and GS and correspondingly losses or gains in time and fuel consumption).	X	X	X	X	X			
061 01 05 06		**Gradient versus rate of climb/descent**								
(01)		Estimate average climb/descent gradient (%) or glide path degrees according to the following rule of thumb: — Gradient in degrees = (vertical distance (ft) / 100) / ground distance (NM)) — Gradient in % = (vertical distance (ft) / 60) / ground distance (NM)) — Gradient in degrees = arctan (altitude difference (ft) / ground distance (ft)). *N.B. These rules of thumb approximate 1 NM to 6 000 ft and are based on the 1:60 rule.*	X	X	X	X	X			
(02)		Calculate rate of descent (ROD) on a given glide-path angle or gradient using the following rule of thumb formulae: — ROD (ft/min) = GP° × GS (NM/min) × 100 — ROD (ft/min) = GP% × GS (kt)	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Calculate climb/descent gradient (ft/NM, % and degrees), GS or vertical speed according to the following formula: — Vertical speed (ft/min) = (GS (kt) × gradient (ft/NM)) / 60.	X	X	X	X	X			
(04)	X	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 01 06 00		**Triangle of velocities (TOV)**								
061 01 06 01		**Construction**								
(01)		Draw and correctly label the TOV.	X	X	X	X	X			
061 01 06 02		**Solutions**								
(01)		Resolve the TOV for: — heading and GS (with mechanical computer and MDR); — WV (with mechanical computer); and — track and GS (with mechanical computer and MDR.	X	X	X	X	X			
(02)		Calculate rate of descent (ROD) on a given glide-path angle or gradient using the following rule of thumb formulae: — ROD (ft/min) = GP° × GS (NM/min) × 100 — ROD (ft/min) = GP% × GS (kt)	X	X	X	X	X			
(03)		Calculate climb/descent gradient (ft/NM, % and degrees), GS or vertical speed according to the following formula: — Vertical speed (ft/min) = (GS (kt) × gradient (ft/NM)) / 60.	X	X	X	X	X			
(04)	X	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			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
061 01 06 00		**Triangle of velocities (TOV)**								
061 01 06 01		**Construction**								
(01)		Draw and correctly label the TOV.	X	X	X	X	X			
061 01 06 02		**Solutions**								
(01)		Resolve the TOV for: — heading and GS (with mechanical computer and MDR); — WV (with mechanical computer); and — track and GS (with mechanical computer and MDR.	X	X	X	X	X			
061 01 07 00		**Dead reckoning (DR)**								
061 01 07 01		**Dead reckoning (DR) technique**								
(01)		Determine a DR position.	X	X	X	X	X			
(02)		Evaluate the difference between a DR and a fix position.	X	X	X	X	X			
(03)		Define ‘speed factor’ (SF). Speed divided by 60, used for mental flight-path calculations.	X	X	X	X	X			
(04)		Calculate wind correction angle (WCA) using the formula: — WCA = XWC (crosswind component)/SF	X	X	X	X	X			
061 01 08 00		**Navigation in climb and descent**								
061 01 08 01		**Average airspeed**								
(01)		Average TAS used for climb problems is calculated at the altitude 2/3 of the cruising altitude.	X	X	X	X	X			
(02)		Average TAS used for descent problems is calculated at the altitude 1/2 of the descent altitude.	X	X	X	X	X			
061 01 08 02		**Average wind velocity (WV)**								
(01)		WV used for climb problems is the WV at the altitude 2/3 of the cruising altitude.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		WV used for descent problems is the WV at the altitude 1/2 of the descent altitude.	X	X	X	X	X			
(03)		Calculate the average climb/descent GS from given TAS at various altitudes, and WV at various altitudes and true track.	X	X	X	X	X			
061 01 08 03		**Ground speed (GS)/distance covered during climb or descent**								
(01)	X	State that most aircraft operating handbooks supply graphical material to calculate climb and descent problems.	X	X	X	X	X			
(02)		Calculate the flying time and distance during climb/descent from given average rate of climb/descent and using average GS using the following formulae valid for a 3°-glide path: — rate of descent = (GS × 10) / 2 — rate of descent = speed factor (SF) × glide-path angle × 100	X	X	X	X	X			
(03)		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			
(04)		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			
(05)		Given speed, distance to go and altitude to climb/descent, calculate the rate of climb/descent.	X	X	X	X	X			
061 02 00 00		**Visual flight rule (VFR) NAVIGATION**								
061 02 01 00		**Ground features**								
061 02 01 01		**Ground features**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Recognise which elements would make a ground feature suitable for use for VFR navigation.	X	X	X	X	X			
061 02 01 02		**Visual identification**								
(01)		Describe the problems of VFR navigation at lower levels and the causes of reduced visibility.	X	X	X	X	X			
(02)		Describe the problems of VFR navigation at night.	X	X	X	X	X			
061 02 02 00		**VFR navigation techniques**								
061 02 02 01		**Use of visual observations and application to in-flight navigation**								
(01)	X	Describe what is meant by the term ‘map reading’.	X	X	X	X	X			
(02)	X	Define the term ‘visual checkpoint’.	X	X	X	X	X			
(03)		Discuss the general features of a visual checkpoint and give examples.	X	X	X	X	X			
(04)		State that the evaluation of the differences between DR positions and actual position can refine flight performance and navigation.	X	X	X	X	X			
(05)	X	Establish fixes on navigational charts by plotting visually derived intersecting lines of position.	X	X	X	X	X			
(06)	X	Describe the use of a single observed position line to check flight progress.	X	X	X	X	X			
(07)	X	Describe how to prepare and align a map/chart for use in visual navigation.	X	X	X	X	X			
(08)		Describe visual-navigation techniques including: — use of DR position to locate identifiable landmarks; — identification of charted features/landmarks;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— 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.								
(09)		Describe the action to be taken if there is no visual checkpoint available at a scheduled turning point.	X	X	X	X	X			
(10)		Understand 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			
(11)	X	State the function of contour lines on a topographical chart.	X	X	X	X	X			
(12)	X	Indicate the role of ‘layer tinting’ (colour gradient) in relation to the depiction of topography on a chart.	X	X	X	X	X			
(13)		Using the contours shown on a chart, describe the appearance of a significant feature.	X	X	X	X	X			
(14)		Apply the techniques of DR, map reading, orientation, timing and revision of ETAs and headings.	X	X	X	X	X			
061 02 02 02		**Unplanned events**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain what needs to be considered in case of diversion, when unsure of position and when lost.	X	X	X	X	X			
061 03 00 00		**GREAT CIRCLES AND RHUMB LINES**								
061 03 01 00		**Great circles**								
061 03 01 01		**Properties**								
(01)		Describe the geometric properties of a great circle (including the vertex) and a small circle.	X	X						
(02)		Describe the geometric properties of a great circle and a small circle, up to 30° difference of longitude.			X	X	X			
(03)	X	Explain why a great-circle route is the shortest distance between any two positions on the Earth.	X	X	X	X	X			
(04)		Name examples of great circles on the surface of the Earth.	X	X	X	X	X			
061 03 01 02		**Convergence**								
(01)	X	Explain why the track direction of a great-circle route (other than following a meridian or the equator) changes.	X	X	X	X	X			
(02)		State the formula used to approximate the value of Earth convergence as change of longitude × sine mean latitude.	X	X	X	X	X			
(03)		Calculate the approximate value of Earth convergence between any two positions, up to 30° difference of longitude.	X	X	X	X	X			
061 03 02 00		**Rhumb lines**								
061 03 02 01		**Properties**								
(01)	X	Describe the geometric properties of a rhumb line.	X	X	X	X	X			
(02)	X	State that a rhumb-line route is not the shortest distance between any two	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		positions on the Earth (excluding meridians and equator).								
061 03 03 00		**Relationship**								
061 03 03 01		**Distances**								
(01)		Explain that the variation in distance of the great-circle route and rhumb-line route between any two positions increases with increasing latitude or change in longitude.	X	X	X	X	X			
061 03 03 02		**Conversion angle**								
(01)		Calculate and apply the conversion angle.	X	X						
061 04 00 00		**CHARTS**								
061 04 01 00		**Chart requirements**								
061 04 01 01		**ICAO Annex 4 'Aeronautical Charts'**								
(01)		State the requirement for conformality and for a straight line to approximate a great circle.	X	X	X	X	X			
061 04 01 02		**Convergence**								
(01)		Explain and calculate the constant of the cone (sine of parallel of origin).	X	X	X	X	X			
(02)		Explain the relationship between Earth and chart convergence with respect to the ICAO requirement for a straight line to approximate a great circle.	X	X	X	X	X			
061 04 01 03		**Scale**								
(01)		Recognise methods of representing scale on aeronautical charts.	X	X	X	X	X			
(02)		Perform scale calculations based on typical en-route chart scales.	X	X	X	X	X			
061 04 02 00		**Projections**								
061 04 02 01		**Methods of projection**								
(01)	X	Identify azimuthal, cylindrical and conical projections.	X	X	X	X	X			
061 04 02 02		**Polar stereographic**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the properties of a polar stereographic projection.	X	X	X	X	X			
(02)		Calculate straight line track changes on a polar stereographic chart.	X	X	X	X	X			
061 04 02 03		**Direct Mercator**								
(01)		State the properties of a direct Mercator projection.	X	X	X	X	X			
(02)		Given the scale at one latitude, calculate the scale at different latitudes.	X	X	X	X	X			
(03)		Given a chart length at one latitude, show that it represents a different Earth distance at other latitudes.	X	X	X	X	X			
061 04 02 04		**Lambert**								
(01)		State the properties of a Lambert projection.	X	X	X	X	X			
(02)		Calculate straight line track changes on a Lambert chart.	X	X	X	X	X			
(03)		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			
(04)		Given appropriate data, calculate initial, final or rhumb-line tracks between two positions (lat./long.).	X	X	X	X	X			
(05)		Given two positions (lat./long.) and information to determine convergency between the two positions, calculate the parallel of origin.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Given a Lambert chart, determine the parallel of origin, or constant of cone.	X	X	X	X	X			
(07)		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 04 03 00		**Practical use**								
061 04 03 01		**Symbology**								
(01)		Recognise ICAO Annex 4 symbology.	X	X	X	X	X			
061 04 03 02		**Plotting**								
(01)		Measure tracks and distances on VFR and IFR en-route charts.	X	X	X	X	X			
(02)		Fix the aircraft position on an en-route chart with information from VOR and DME equipment.	X	X	X	X	X			
(03)		Resolve bearings of an NDB station for plotting on an aeronautical chart.	X	X	X	X	X			
061 05 00 00		**Time**								
061 05 01 00		**Local Mean Time (LMT)**								
061 05 01 01		**Mean Solar day**								
(01)	X	Explain the concepts of a mean solar day and LMT.	X	X	X	X	X			
061 05 01 02		**Local Mean Time (LMT) and Universal Time Coordinated (UTC)**								
(01)		Perform LMT and UTC calculations.	X	X	X	X	X			
061 05 02 00		**Standard time**								
061 05 02 01		**Standard time and daylight-saving time**								
(01)		Explain and apply the concept of standard time and daylight saving time, and perform standard time and daylight saving time calculations.	X	X	X	X	X			
061 05 02 02		**International Date Line**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the changes when crossing the International Date Line.	X	X	X	X	X			
061 05 03 00		**Sunrise and sunset**								
061 05 03 01		**Sunrise and sunset times**								
(01)		Define sunrise, sunset, and civil twilight, and extract times from a suitable source (e.g. an almanac).	X	X	X	X	X			
(02)		Explain the changes to sunrise, sunset, and civil twilight times with date, latitude and altitude.	X	X	X	X	X			
(03)		Explain at which time of the year the duration of daylight changes at the highest rate.	X	X	X	X	X			

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SUBJECT 062 – NAVIGATION – RADIO NAVIGATION

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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**								
(01)	X	State that radio waves travel at the speed of light, being approximately 300 000 km/s.	X	X	X	X	X	X		
(02)	X	Define a ‘cycle’: a complete series of values of a periodical process.	X	X	X	X	X	X		
062 01 01 02		**Frequency, wavelength, amplitude, phase angle**								
(01)	X	Define ‘frequency’: the number of cycles occurring in 1 second expressed in Hertz (Hz).	X	X	X	X	X	X		
(02)	X	Define ‘wavelength’: the physical distance travelled by a radio wave during one cycle of transmission.	X	X	X	X	X	X		
(03)	X	Define ‘amplitude’: the maximum deflection in an oscillation or wave.	X	X	X	X	X	X		
(04)	X	State that the relationship between wavelength and frequency is: wavelength (λ) = speed of light (c) / frequency (f).	X	X	X	X	X	X		
(05)	X	Define ‘phase angle’: the fraction of one wavelength expressed in degrees from 000° to 360°.	X	X	X	X	X	X		
(06)	X	Define ‘phase angle 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		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
062 01 01 03		**Frequency bands, sidebands, single sideband**								
(01)		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		
(02)		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		
(03)		State that HF meteorological information for aircraft in flight (VOLMET) and HF two-way communication use a single sideband.	X	X	X	X	X	X		
(04)		State that the following abbreviations (classifications according to International Telecommunication Union (ITU) regulations) are used for aviation applications: — N0N: carrier without modulation as used by nondirectional radio beacons (NDBs); — A1A: carrier with keyed Morse code modulation as used by NDBs;	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— A2A: carrier with amplitude modulated Morse code as used by NDBs; — A3E: carrier with amplitude modulated speech used for communication (VHF-COM).								
062 01 01 04		**Pulse characteristics**								
(01)		Define the following terms that are associated with a pulse string: — pulse length; — pulse power; — continuous power.	X	X	X	X	X	X		
062 01 01 05		**Carrier, modulation**								
(01)	X	Define ‘carrier wave’: the radio wave acting as the carrier or transporter.	X	X	X	X	X	X		
(02)	X	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)**								
(01)	X	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		
(02)	X	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		
(03)	X	Describe ‘pulse modulation’: a modulation form used in radar by transmitting short pulses followed by larger interruptions.	X	X	X	X	X	X		
(04)	X	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**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
062 01 02 01		**Characteristics**								
(01)	X	Define ‘antenna’: an antenna or aerial is an electrical device which converts electric power into radio waves, and vice versa.	X	X	X	X	X	X		
(02)	X	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		
(03)	X	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		
(04)	X	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		
062 01 02 02		**Polarisation**								
(01)	X	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		
062 01 02 03		**Types of antennas**								
(01)		Name the common different types of directional antennas: — loop antenna used in old automatic direction-finding (ADF) receivers; — parabolic antenna used in weather radars; — slotted planar array used in more modern weather radars.	X	X	X	X	X	X		
(02)		Explain ‘antenna shadowing’.	X	X	X	X	X			
(03)		Explain the importance of antenna placement on aircraft.	X	X	X	X	X			
062 01 03 00		**Wave propagation**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
062 01 03 01		**Structure of the ionosphere and its effect on radio waves**								
(01)	X	State that the ionosphere is the ionised component of the Earth's upper atmosphere from approximately 60 to 400 km above the surface, which is vertically structured in three regions or layers.	X	X	X	X	X			
(02)	X	State that the layers of the ionosphere are named D, E and F layers, and their depth varies with time.	X	X	X	X	X			
(03)	X	State that electromagnetic waves refracted from the E and F layers of the ionosphere are called sky waves.	X	X	X	X	X			
(04)	X	Explain how the different layers of the ionosphere influence wave propagation.	X	X	X	X	X			
062 01 03 02		**Ground waves**								
(01)	X	Define 'ground or surface waves': the electromagnetic waves travelling along the surface of the Earth.	X	X	X	X	X			
062 01 03 03		**Space waves**								
(01)	X	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**								
(01)		State that radio waves in VHF, UHF, SHF and EHF propagate as space waves.	X	X	X	X	X	X		
(02)		State that radio waves in LF, MF and HF propagate as surface/ground waves and sky waves.	X	X	X	X	X	X		
062 01 03 05		**Doppler principle**								
(01)	X	State that the Doppler effect is the phenomenon where the frequency of a wave will increase or decrease if there is	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		relative motion between the transmitter and the receiver.								
062 01 03 06		**Factors affecting propagation**								
(01)	X	Define 'skip distance': the distance between the transmitter and the point on the surface of the Earth where the first sky wave return arrives.	X	X	X	X	X	X		
(02)		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		
(03)		Describe 'fading': when a receiver picks up two signals with the same frequency, and the signals will interfere with each other causing changes in the resultant signal strength and polarisation.	X	X	X	X	X	X		
(04)		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		
(05)	X	Describe the physical phenomena 'reflection', 'refraction', 'diffraction', 'absorption' and 'interference'.	X	X	X	X	X	X		
(06)		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 02 00 00		**RADIO AIDS**								
062 02 01 00		**Ground direction finding (DF)**								
062 02 01 01		**Principles**								
(01)	X	Describe the use of a ground DF.	X	X	X	X	X	X		
(02)		Explain the limitation of range because of the path of the VHF signal.	X	X	X	X	X	X		
062 02 01 02		**Presentation and interpretation**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Define the term 'QDM': the magnetic bearing to the station.	X	X	X	X	X	X	X	
(02)		Define the term 'QDR': the magnetic bearing from the station.	X	X	X	X	X	X	X	
(03)		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**								
(01)		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	X	
062 02 01 04		**Errors and accuracy**								
(01)	X	Explain why synchronous transmissions will cause errors.	X	X	X	X	X	X		
(02)	X	Describe the effect of 'multipath signals'.	X	X	X	X	X	X		
(03)		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 radio beacon (NDB)/automatic direction finding (ADF)**								
062 02 02 01		**Principles**								
(01)	X	Define the acronym 'NDB': non-directional radio beacon.	X	X	X	X	X	X	X	
(02)	X	Define the acronym 'ADF': automatic direction-finding equipment.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)	X	State that the NDB is the ground part of the system.	X	X	X	X	X	X	X	
(04)	X	State that the ADF is the airborne part of the system.	X	X	X	X	X	X	X	
(05)		State that the NDB operates in the LF and MF frequency bands.	X	X	X	X	X	X	X	
(06)		State that the frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is 190–1 750 kHz.	X	X	X	X	X	X	X	
(07)		Define a 'locator beacon': an LF/MF NDB used as an aid to final approach usually with a range of 10–25 NM.	X	X	X	X	X	X	X	
(08)	X	State that certain commercial radio stations transmit within the frequency band of the NDB.	X	X	X	X	X	X	X	
(09)	X	State that according to ICAO Annex 10, an NDB station has an automatic ground monitoring system.	X	X	X	X	X	X	X	
(10)		Describe the use of NDBs for navigation.	X	X	X	X	X	X	X	
(11)		Describe the procedure to identify an NDB station.	X	X	X	X	X	X	X	
(12)	X	Interpret the term 'cone of confusion' in respect of an NDB.	X	X	X	X	X	X	X	
(13)	X	State that an NDB station emits a N0N/A1A or a N0N/A2A signal.	X	X	X	X	X	X	X	
(14)	X	State the function of the beat frequency oscillator (BFO).	X	X	X	X	X	X	X	
(15)	X	State that in order to identify a N0N/A1A NDB, the BFO circuit of the receiver has to be activated.	X	X	X	X	X	X	X	
(16)	X	State that on modern aircraft, the BFO is activated automatically.	X	X	X	X	X	X	X	
062 02 02 02		**Presentation and interpretation**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Name the types of indicators commonly in use: — electronic display; — radio magnetic indicator (RMI); — fixed-card ADF (radio compass); — moving-card ADF.	X	X	X	X	X	X	X	
(02)		Interpret the indications given on RMI, fixed-card and moving-card ADF displays.	X	X	X	X	X	X	X	
(03)		Given a display, interpret the relevant ADF information.	X	X	X	X	X	X	X	
(04)		Calculate the true bearing from the compass heading and relative bearing.	X	X	X	X	X	X	X	
(05)		Convert the compass bearing into magnetic bearing and true bearing.	X	X	X	X	X	X	X	
(06)		Describe how to fly the following in-flight ADF procedures: — homing and tracking, and explain the influence of wind; — interception of inbound QDM and outbound QDR; — changing from one QDM/QDR to another; — determining station passage and the abeam point.	X	X	X	X	X	X	X	
062 02 02 03		**Coverage and range**								
(01)	X	State that the power of the transmitter limits the range of an NDB.	X	X	X	X	X	X	X	
(02)		Explain the relationship between power and range.	X	X	X	X	X	X	X	
(03)	X	Describe the propagation path of NDB radio waves with respect to the ionosphere and the Earth’s surface.	X	X	X	X	X	X	X	
(04)		Explain that the interference between sky waves and ground waves leads to ‘fading’.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Define that the accuracy the pilot has to fly the required bearing in order to be considered established during approach, according to ICAO Doc 8168, has to be within ± 5°.	X	X	X	X	X	X	X	
(06)		State that there is no warning indication of NDB failure.	X	X	X	X	X	X	X	
062 02 02 04		**Errors and accuracy**								
(01)	X	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	X	
(02)	X	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	X	
(03)		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	X	
062 02 02 05		**Factors affecting range and accuracy**								
(01)		Describe diffraction of radio waves in mountainous terrain (mountain effect).	X	X	X	X	X	X	X	
(02)		State that static radiation energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.	X	X	X	X	X	X	X	
(03)		Explain that the bank angle of the aircraft causes a dip error.	X	X	X	X	X	X	X	
062 02 03 00		**VHF omnidirectional radio range (VOR): conventional VOR (CVOR) and Doppler VOR (DVOR)**								
062 02 03 01		**Principles**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Explain the working principle of VOR using the following general terms: — reference phase; — variable phase; — phase difference.	X	X	X	X	X	X		
(02)		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	X	
(03)		State that frequencies within the allocated VOR range 108.0– 111.975 MHz, which have an odd number in the first decimal place, are used by instrument landing system (ILS).	X	X	X	X	X	X	X	
(04)		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 aerodromes; — test VOR (VOT): a VOR station emitting a signal to test VOR indicators in an aircraft.	X	X	X	X	X	X	X	
(05)		State that automatic terminal information service (ATIS) information is transmitted on VOR frequencies.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)	X	List the three main components of VOR airborne equipment: — the antenna; — the receiver; — the indicator.	X	X	X	X	X	X	X	
(07)		Describe the identification of a VOR in terms of Morse-code letters and additional plain text.	X	X	X	X	X	X	X	
(08)	X	State that according to ICAO Annex 10, a VOR station has an automatic ground monitoring system.	X	X	X	X	X	X		
(09)		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	X	
062 02 03 02		**Presentation and interpretation**								
(01)		Read off the radial on an RMI.	X	X	X	X	X	X		
(02)		Read off the angular displacement in relation to a preselected radial on a horizontal situation indicator (HSI) or omni-bearing indicator (OBI).	X	X	X	X	X	X		
(03)		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		
(04)		Interpret VOR information as displayed on HSI, CDI and RMI.	X	X	X	X	X	X		
(05)		Describe the following in-flight VOR procedures: — tracking, and explain the influence of wind when tracking; — interception of a radial inbound and outbound to/from a VOR;	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— changing from one radial inbound/outbound to another; — determining station passage and the abeam point.								
(06)		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		**Intentionally left blank**								
062 02 03 04		**Errors and accuracy**								
(01)		Define that 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, has to be within the half-full scale deflection of the required track.	X	X	X	X	X	X	X	
(02)		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	X	
062 02 04 00		**Distance-measuring equipment (DME)**								
062 02 04 01		**Principles**								
(01)		State that DME operates in the UHF band.	X	X	X	X	X	X	X	
(02)	X	State that the system comprises two basic components: — the aircraft component: the interrogator; — the ground component: the transponder.	X	X	X	X	X	X	X	
(03)		Describe the principle of distance measurement using DME in terms of a timed transmission from the interrogator and reply from the transponder on different frequencies.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain that the distance measured by DME is slant range.	X	X	X	X	X	X	X	
(05)		Illustrate that a position line using DME is a circle with the station at its centre.	X	X	X	X	X	X	X	
(06)		State that 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	X	
(07)	X	Describe, in the case of co-location with VOR and ILS, the frequency pairing and identification procedure.	X	X	X	X	X	X	X	
(08)		State that military UHF tactical air navigation aid (TACAN) stations may be used for DME information.	X	X	X	X	X	X	X	
062 02 04 02		**Presentation and interpretation**								
(01)	X	State that when identifying a DME station co-located with a VOR station, the identification signal with the higher-tone frequency is the DME which identifies itself approximately every 40 seconds.	X	X	X	X	X	X	X	
(02)		Calculate ground distance from given slant range and altitude.	X	X	X	X	X	X	X	
(03)		Describe the use of DME to fly a DME arc in accordance with ICAO Doc 8168 Volume 1.	X	X	X	X	X	X	X	
(04)	X	State that a DME system may have a ground speed (GS) and time to station read-out combined with the DME read-out.	X	X	X	X	X	X	X	
062 02 04 03		**Coverage and range**								
(01)		Explain why a ground station can generally respond to a maximum of 100 aircraft.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain which aircraft will be denied a DME range first when more than 100 interrogations are being made.	X	X	X	X	X	X	X	
062 02 04 04		**Intentionally left blank**								
062 02 04 05		**Factors affecting range and accuracy**								
(01)		Explain why the GS read-out from a DME can be less than the actual GS, and is zero when flying a DME arc.	X	X	X	X	X	X	X	
062 02 05 00		**Instrument landing system (ILS)**								
062 02 05 01		**Principles**								
(01)		Name the three main components of an ILS: — the localiser (LOC); — the glide path (GP); — range information (markers or DME).	X		X			X	X	
(02)	X	State the site locations of the ILS components: — the LOC antenna should be located on the extension of the runway centre line at the stop-end; — the GP antenna should be located beyond the runway threshold, laterally displaced to the side of the runway centre line.	X		X			X	X	
(03)		Explain that marker beacons produce radiation patterns to indicate predetermined distances from the threshold along the ILS GP.	X		X			X	X	
(04)		State that marker beacons are sometimes replaced by a DME paired with the LOC frequency.	X		X			X	X	
(05)		State that in the ILS LOC frequency assigned band 108.0– 111.975 MHz, only	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		frequencies which have an odd number in the first decimal are ILS LOC frequencies.								
(06)		State that the GP operates in the UHF band.	X		X			X	X	
(07)	X	Describe the use of the 90-Hz and the 150-Hz signals in the LOC and GP transmitters/receivers, stating how the signals at the receivers vary with angular deviation.	X		X			X	X	
(08)		State that the UHF GP frequency is selected automatically by being paired with the LOC frequency.	X		X			X		
(09)		Explain that both the LOC and the GP antenna radiates side lobes (false beams) which can give rise to false centre-line and false GP indication.	X		X			X	X	
(10)	X	Explain that the back beam from the LOC antenna may be used as a published 'non-precision approach'.	X		X			X	X	
(11)		State that the recommended GP is 3°.	X		X			X	X	
(12)		Name the frequency, modulation and identification assigned to all marker beacons. All marker beacons operate on 75-MHz carrier frequency. The modulation frequencies of the audio are: — outer marker: low; — middle marker: medium; — inner marker: high. 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;	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— middle marker: a continuous series of alternate dots and dashes; — inner marker: 6 dots per second continuously. — The outer-marker cockpit indicator is coloured blue, the middle marker amber, and the inner marker white.								
(13)		State that the final-approach area contains a fix or facility that permits verification of the ILS GP–altimeter relationship. The outer marker or DME is usually used for this purpose.	X		X			X	X	
062 02 05 02		**Presentation and interpretation**								
(01)		Describe the ILS identification regarding frequency and Morse code or plain text.	X		X			X	X	
(02)		State that an ILS installation has an automatic ground monitoring system.	X		X			X		
(03)		State that the LOC and GP monitoring system monitors any shift in the LOC and GP mean course line or reduction in signal strength.	X		X			X		
(04)		State that warning flags will appear for both the LOC and the GP if the received signal strength is below a threshold value.	X		X			X	X	
(05)		Describe the circumstances in which warning flags will appear for both the LOC and the GP: — absence of the carrier frequency; — absence of the modulation simultaneously; — the percentage modulation of the navigation signal reduced to 0.	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Interpret the indications on a CDI and an 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	X	
(07)		Interpret the aircraft's position in relation to the extended runway centre line on a back-beam approach.	X		X			X		
(08)		Explain the setting of the course pointer of an HSI and the course selector of an omni-bearing indicator (OBI) for front-beam and back-beam approaches.	X		X			X		
062 02 05 03		**Coverage and range**								
(01)		Sketch the standard coverage area of the LOC and GP with angular sector limits in degrees and distance limits from the transmitter: LOC 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	X	
062 02 05 04		**Errors and accuracy**								
(01)		Explain that ILS approaches are divided into facility performance categories defined in ICAO Annex 10.	X		X			X	X	
(02)		Define the following ILS operation categories: — Category I;	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— Category II; — Category IIIA; — Category IIIB; — Category IIIC.								
(03)		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		
(04)		Explain why the accuracy requirements are progressively higher for CAT I, CAT II and CAT III ILS.	X		X			X		
(05)		Explain the following in accordance with ICAO Doc 8168: — the accuracy the pilot has to fly the ILS LOC 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 LOC 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	X	
(06)		State that if a pilot deviates by more than half-course deflection on the LOC or by more than half-dot deflection on the GP, an immediate go-around should be executed because obstacle clearance may no longer be guaranteed.	X		X			X	X	
(07)		Describe ILS beam bends as deviations from the nominal LOC and GP respectively which can be assessed by flight test.	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Explain that multipath interference is caused by reflections from objects within the ILS coverage area.	X		X			X		
062 02 05 05		**Factors affecting range and accuracy**								
(01)		Define the 'ILS-critical area': an area of defined dimensions around the LOC and GP antennas where vehicles, including aircraft, are excluded during all ILS operations.	X		X			X	X	
(02)		Define the 'ILS-sensitive area': an area extending beyond the ILS-critical area where the parking 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	X	
062 02 06 00		**Microwave landing system (MLS)**								
062 02 06 01		**Principles**								
(01)		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		
(02)		State that MLS operates in the SHF band on any one of 200 channels, on assigned frequencies.	X		X			X		
(03)		Explain the reason why MLS can be installed at aerodromes where, as a result	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		of the effects of surrounding buildings or terrain, ILS siting is difficult.								
062 02 06 02		**Presentation and interpretation**								
(01)		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		
(02)		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		
(03)		Illustrate that segmented and curved approaches can only be executed with DME/P installed.	X		X			X		
(04)		Explain why aircraft are equipped with a multimode receiver (MMR) in order to be able to receive ILS, MLS and GPS.	X		X			X		
(05)		Explain why MLS without DME/P gives an ILS lookalike straight-line approach.	X		X			X		
062 02 06 03		**Coverage and range**								
(01)		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 03 00 00		**RADAR**								
062 03 01 00		**Pulse techniques**								
062 03 01 01		**Pulse techniques and associated terms**								
(01)		Name the different applications of radar with respect to air traffic control (ATC),	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		weather observations, and airborne weather radar (AWR).								
(02)	X	Describe the pulse technique and echo principle on which primary radar systems are based.	X	X	X	X	X	X		
(03)	X	State that the range of a radar depends on pulse repetition frequency (PRF), pulse length, pulse power, height of aircraft, height of antenna and frequency used.	X	X	X	X	X	X		
062 03 02 00		**Ground radar**								
062 03 02 01		**Principles**								
(01)		Explain that primary radar provides bearing and distance of targets.	X		X	X		X	X	
(02)	X	Explain that primary ground radar is used to detect aircraft that are not equipped with a secondary radar transponder.	X		X	X		X	X	
062 03 02 02		**Presentation and interpretation**								
(01)		State that modern ATC systems use inputs from various sensors to generate the display.	X		X	X		X	X	
(02)		State that modern weather radars employ frequencies that give wavelengths of about 3 cm that reflect best on wet hailstones.	X		X	X		X	X	
(03)	X	State that the antenna is stabilised in the horizontal plane with signals from the aircraft's attitude reference system.	X		X	X		X	X	
(04)	X	Describe the cone-shaped pencil beam of about 3 to 5° beam width used for weather detection.	X		X	X		X	X	
062 03 03 02		**Presentation and interpretation**								
(01)		Explain the functions of the following different controls on the radar control panel: — off/on switch; — function switch	X		X	X		X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		with WX, WX+T and MAP modes; — gain-control setting (auto/manual); — tilt/autotilt switch.								
(02)		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	X	
(03)	X	State the use of azimuth-marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm on the screen.	X		X	X		X	X	
062 03 03 03		**Coverage and range**								
(01)		Explain how the radar is used for weather detection and for mapping (range, tilt and gain, if available).	X		X	X		X	X	
062 03 03 04		**Errors, accuracy, limitations**								
(01)		Explain why AWR should be used with extreme caution when on the ground.	X		X	X		X	X	
062 03 03 05		**Factors affecting range and accuracy**								
(01)		Explain the danger of the area behind heavy rain (shadow area) where no radar waves will penetrate.	X		X	X		X	X	
(02)		Describe appropriate tilt settings in relation to altitude and thunderstorms.	X		X	X		X	X	
(03)		Explain why a thunderstorm may not be detected when the tilt is set too high.	X		X	X		X	X	
(04)		Explain how wind shear can be detected by a modern weather radar.	X		X	X		X	X	
062 03 04 00		**Secondary surveillance radar and transponder**								
062 03 04 01		**Principles**								
(01)		State that the ATC system is based on the replies provided by the airborne	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		transponders in response to interrogations from the ATC secondary radar.								
(02)	X	State 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	X	
(03)	X	State that an airborne transponder provides coded-reply signals in response to interrogation signals from the ground secondary radar and from aircraft equipped with traffic alert and collision avoidance system (TCAS).	X	X	X	X	X	X	X	
(04)		State the advantages of secondary surveillance radar (SSR) over a primary radar regarding range and collected information due to transponder principal information and active participation of the aircraft.	X	X	X	X	X	X	X	
062 03 04 02		**Modes and codes**								
(01)	X	State that the interrogator transmits its interrogations in the form of a series of pulse pairs.	X	X	X	X	X	X	X	
(02)		Name the interrogation modes: — Mode A; — Mode C; — Mode S.	X	X	X	X	X	X	X	
(03)		State that the interrogation frequency and the reply frequency are different.	X	X	X	X	X			
(04)		Explain that the decoding of the time interval between the pulse pairs determines the operating mode of the transponder: — Mode A: transmission of aircraft transponder code;	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— Mode C: transmission of aircraft pressure altitude; — Mode S: selection of aircraft address and transmission of flight data for the ground surveillance.								
(05)		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	X	
(06)		State that in Mode C reply, the pressure altitude is reported in 100-ft increments.	X	X	X	X	X	X		
(07)		State that in addition to the information provided, on request from ATC, a special position identification (SPI) pulse can be transmitted but only as a result of a manual selection by the pilot (IDENT button).	X	X	X	X	X	X		
(08)	X	State the need for compatibility of Mode S with Mode A and C.	X	X	X	X	X	X		
(09)		Explain that Mode S transponders receive interrogations from TCAS and SSR ground stations.	X	X	X	X	X	X		
(10)	X	State that Mode S interrogation contains either the aircraft address, selective call or all-call address.	X	X	X	X	X	X		
(11)		State that every aircraft is allocated an ICAO aircraft address, which is hard-coded into the Mode S transponder (Mode S address).	X	X	X	X	X	X	X	
(12)		Explain that a 24-bit address is used in all Mode S transmissions, so that every interrogation can be directed to a specific aircraft.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(13)		State that Mode S can provide enhanced vertical tracking, using a 25-ft altitude increment.	X	X	X	X	X	X		
(14)		State that SSR can be used for automatic dependent surveillance — broadcast (ADS-B).	X	X	X	X	X	X		
062 03 04 03		**Presentation and interpretation**								
(01)		State that an aircraft can be identified by a unique code.	X	X	X	X	X	X	X	
(02)		State which information can be presented on the ATC display system: — pressure altitude; — flight level; — flight number or aircraft registration number; — GS.	X	X	X	X	X	X	X	
(03)	X	Explain the use and function of the selector modes: OFF, Standby, ON (Mode A), ALT (Mode A, C and S), TEST, and of the reply lamp.	X	X	X	X	X	X	X	
062 04 00 00		**INTENTIONALLY LEFT BLANK**								
062 05 00 00		**INTENTIONALLY LEFT BLANK**								
062 06 00 00		**GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSSs)**								
062 06 01 00		**Global navigation satellite systems (GNSSs)**								
062 06 01 01		**General**								
(01)		State that there are four main GNSSs. These are: — USA NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS); — Russian GLObal NAvigation Satellite System (GLONASS);	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— European Galileo (under construction); — Chinese BeiDou (under construction).								
(02)	X	State that all four 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	X	
062 06 01 02		**Operation**								
		Global navigation satellite system (GNSS)								
(01)		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	X	
(02)		SPS was originally designed to provide civilian users with a less accurate positioning capability than PPS.	X	X	X	X	X	X	X	
(03)	X	Name the three GNSS segments as follows: — space segment; — control segment; — user segment.	X	X	X	X	X	X	X	
		Space segment (example: NAVSTAR GPS)								
(04)		State that each satellite broadcasts ranging signals on two UHF frequencies: L1 and L2.	X	X	X	X	X	X		
(05)		State that SPS is a positioning and timing service provided on frequency L1.	X	X	X	X	X	X		
(06)		State that PPS uses both frequencies L1 and L2.	X	X	X	X	X	X		
(07)	X	State that the satellites transmit a coded signal used for ranging, identification	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		(satellite individual PRN code), timing and navigation.								
(08)	X	State that the navigation message contains: — satellite clock correction parameters; — Universal Time Coordinated (UTC) parameters; — an ionospheric model; — satellite health data.	X	X	X	X	X	X		
(09)	X	State that an ionospheric model is used to calculate the time delay of the signal travelling through the ionosphere.	X	X	X	X	X	X		
(10)	X	State that two codes are transmitted on the L1 frequency, namely a coarse acquisition (C/A) code and a precision (P) code. The P code is not used for standard positioning service (SPS).	X	X	X	X	X			
(11)	X	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								
(12)	X	State that the control segment comprises: — a master control station; — a ground antenna; — monitoring stations.	X	X	X	X	X	X		
(13)	X	State that the control segment provides: — monitoring of the constellation status; — correction of orbital parameters; — navigation data uploading.	X	X	X	X	X	X		
		User segment								
(14)	X	State that GNSS supplies three-dimensional position fixes and speed data, plus a precise time reference.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(15)	X	State that a GNSS 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		
(16)	X	State that the initial distance calculated to the satellites is called pseudo-range because the difference between the GNSS receiver and the satellite time references initially creates an erroneous range.	X	X	X	X	X			
(17)	X	State that each range defines a sphere with its centre at the satellite.	X	X	X	X	X	X	X	
(18)	X	State that there are four unknown parameters (x, y, z and Δt) (receiver clock error) which require the measurement of ranges to four different satellites in order to get the position.	X	X	X	X	X	X	X	
(19)	X	State that the GNSS receiver is able to synchronise to the correct time reference when receiving four satellites.	X	X	X	X	X	X	X	
(20)	X	State that the receiver is able to calculate aircraft ground speed using the space vehicle (SV) Doppler frequency shift or the change in receiver position over time.	X	X	X	X	X	X		
		NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS) integrity								
(21)		Define ‘receiver autonomous integrity monitoring (RAIM)’ as a technique that ensures the integrity of the provided data by redundant measurements.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(22)		State that RAIM is achieved by consistency checks among range measurements.	X	X	X	X	X	X	X	
(23)		State that basic RAIM requires five satellites. A sixth one is for isolating a faulty satellite from the navigation solution.	X	X	X	X	X	X	X	
(24)		State that agreements have been concluded between the appropriate agencies for the compatibility and interoperability by any approved user of NAVSTAR and GLONASS systems.	X	X	X	X	X	X		
(25)	X	State that the different GNSSs use different data with respect to reference systems, orbital data, and navigation services.	X	X	X	X	X	X		
062 06 01 03		**Errors and factors affecting accuracy**								
(01)		List the most significant factors that affect accuracy: — ionospheric propagation delay; — dilution of precision; — satellite clock error; — satellite orbital variations; — multipath.	X	X	X	X	X	X		
(02)		State that a user equivalent range error (UERE) can be computed from all these factors.	X	X	X	X	X	X		
(03)	X	State that the error from the ionospheric propagation delay (IPD) can be reduced by modelling, using a model of the ionosphere, or can almost be eliminated by using two frequencies.	X	X	X	X	X	X		
(04)	X	State that ionospheric delay is the most significant error.	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		State that dilution of precision arises from the geometry and number of satellites in view. It is called geometric dilution of precision (GDOP).	X	X	X	X	X	X		
(06)		State that the UERE in combination with the geometric dilution of precision (GDOP) allows for an estimation of position accuracy.	X	X	X	X	X	X		
(07)	X	State that errors in the satellite orbits are due to: — solar winds; — gravitation of the Sun and the Moon.	X	X	X	X	X	X		
062 06 02 00		**Ground-, satellite- and aircraft-based augmentation systems**								
062 06 02 01		**Ground-based augmentation systems (GBASs)**								
(01)		Explain the principle of a GBAS: to measure on the ground the errors in the signals transmitted by GNSS satellites and relay the measured errors to the user for correction.	X	X	X	X	X	X	X	
(02)	X	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	X	
(03)		State that for a GBAS station the coverage is about 20 NM.	X	X	X	X	X	X	X	
(04)		State that GBAS provides information for guidance in the terminal area, and for three-dimensional guidance in the final approach segment (FAS) by transmitting the FAS data block.	X	X	X	X	X	X	X	
(05)		State that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with	X	X	X	X	X	X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		approach data, corrections and integrity information for GNSS satellites in view via a VHF data broadcast (VDB).								
(06)	X	State that the minimum software designed coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path up to a distance of 15 NM.	X	X	X	X	X	X		
(07)		State that outside this area the FAS data of GBAS is not used.	X	X	X	X	X	X		
(08)	X	State that GBAS based on GPS is sometimes called local area augmentation system (LAAS).	X	X	X	X	X	X		
(09)		State that a GBAS-based approach is called GLS approach (GLSGNSS landing system).	X	X	X	X	X	X		
062 06 02 02		**Satellite-based augmentation systems (SBASs)**								
(01)	X	Explain the principle of an SBAS: to measure on the ground the errors in the signals received from the satellites and transmit differential corrections and integrity messages for navigation satellites.	X	X	X	X	X	X	X	
(02)	X	State that the frequency band of the data link is identical to that of the GPS signals.	X	X	X	X	X	X	X	
(03)	X	Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas.	X	X	X	X	X	X	X	
(04)	X	State that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites.	X	X	X	X	X	X	X	
(05)	X	State that SBAS consists of two elements:	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— ground infrastructure (monitoring and processing stations); — communication satellites.								
(06)		State that SBAS allows the implementation of three-dimensional Type A and Type B approaches.	X	X	X	X	X	X	X	
(07)	X	State the following examples of SBAS: — European Geostationary Navigation Overlay Service (EGNOS) in western Europe and the Mediterranean; — wide area augmentation system (WAAS) in the USA; — multi-functional transport satellite (MTSAT)-based augmentation system (MSAS) in Japan; — GPS and geostationary earth orbit augmented navigation (GAGAN) in India	X	X	X	X	X	X	X	
(08)	X	State that SBAS is designed to significantly improve accuracy and integrity.	X	X	X	X	X	X	X	
(09)		Explain that integrity and safety are improved by alerting SBAS users within 6 seconds if a GPS malfunction occurs.	X	X	X	X	X	X	X	
062 06 02 03		**Intentionally left blank**								
062 06 02 04		**Aircraft-based augmentation systems (ABASs)**								
(01)		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	X	

EASA ENDORSED

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		State that the type of ABAS using only GNSS information is named receiver autonomous integrity monitoring (RAIM).	X	X	X	X	X	X	X	
(03)		State that a system using information from additional onboard sensors is named aircraft autonomous integrity monitoring (AAIM).	X	X	X	X	X	X	X	
(04)		Explain that the typical sensors used are barometric altimeter and inertial reference system (IRS).	X	X	X	X	X	X	X	
062 07 00 00		**PERFORMANCE-BASED NAVIGATION (PBN)**								
062 07 01 00		**Performance-based navigation (PBN) concept (as described in ICAO Doc 9613)**								
062 07 01 01		**PBN principles**								
(01)		List the factors used to define area navigation (RNAV) or required navigation performance (RNP) system performance requirements (accuracy, integrity and continuity).	X		X			X	X	
(02)	X	State that these RNAV and RNP systems are necessary to optimise the utilisation of available airspace.	X		X			X		
(03)		State that it is necessary for flight crew and air traffic controllers to be aware of the on-board RNAV or RNP system capabilities in order to determine whether the performance of the RNAV or RNP system is appropriate for the specific airspace requirements.	X		X			X		
(04)		Define accuracy as the conformance of the true position and the required position.	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Define continuity as the capability of the system to perform its function without unscheduled interruptions during the intended operation.	X		X			X	X	
(06)		Define integrity as a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid alerts to the user.	X		X			X	X	
(07)		State that, unlike conventional navigation, PBN is not sensor-specific.	X		X			X	X	
(08)		Explain the difference between raw data and computed data.	X		X			X	X	
(09)		Define availability as the percentage of time (annually) during which the system is available for use.	X		X			X	X	
062 07 01 02		**PBN components**								
(01)		List the components of PBN as navigational aid (NAVAID) infrastructure, navigation specification and navigation application.	X		X			X		
062 07 01 03		**PBN Scope**								
(01)		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		
(02)		State that in the approach phases of flight, PBN accommodates both linear and angular laterally guided operations, and explain the difference between the two.	X		X			X		
062 07 02 00		**Navigation specifications**								
062 07 02 01		**Area navigation (RNAV) and required navigation performance (RNP)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the difference between RNAV and RNP in terms of the requirement for on-board performance monitoring and alerting.	X		X			X	X	
062 07 02 02		**Navigation functional requirements**								
(01)		Interpret X in RNAV X or RNP X as the lateral navigation (LNAV) accuracy (total system error) in nautical miles, which is expected to be achieved at least 95 % of the flight time by the population of aircraft operating within the given airspace, route or procedure.	X		X			X		
(02)		State that aircraft approved to the more stringent accuracy requirements may not necessarily meet some of the functional requirements of the navigation specification that has a less stringent accuracy requirement.	X		X			X	X	
(03)		State that RNAV 10 and RNP 4 are used in the oceanic/remote phase of flight.	X		X			X		
(04)		State that RNAV 5 is used in the en-route and arrival phases of flight.	X		X			X	X	
(05)		State that RNAV 2 and RNP 2 are also used as navigation specifications.	X		X			X		
(06)		State that RNP 2 is used in the en-route and oceanic/remote phases of flight.	X		X			X		
(07)		State that RNAV 2 might be used in the en-route continental, arrival and departure phases of flight.	X		X			X		
(08)		State that RNAV 1 and RNP 1 are used in the arrival and departure phases of flight.	X		X			X	X	
(09)		State that required navigation performance approach (RNP APCH) is used in the approach phase of flight.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(10)		State that required navigation performance authorisation required approach (RNP AR APCH) is used in the approach phase of flight.	X		X			X	X	
(11)		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		
(12)		State that RNAV 1, RNP 1 and RNP 0.3 may also be used in en-route phases of low-level instrument flight rule (IFR) helicopter flights.	X		X			X		
062 07 03 00		**Use of performance-based navigation (PBN)**								
062 07 03 01		**Intentionally left blank**								
062 07 03 02		**Intentionally left blank**								
062 07 03 03		**Specific RNAV and RNP system functions**								
(01)		Recognise the definition of radius to fix (RF) leg.	X		X			X	X	
(02)		Recognise the definition of a fixed radius transition (FRT).	X		X			X	X	
(03)		State the importance of respecting the flight director guidance and the speed constraints associated with an RF procedure.	X		X			X	X	
(04)		Explain the difference between a fly-by-turn and a fly-over.	X		X			X	X	
(05)		State that the Aeronautical Radio, Incorporated (ARINC) 424 path terminators set the standards for coding the SIDs, STARs and instrument approach procedures (IAPs) from the official published government source	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		documentation into the ARINC navigation database format.								
(06)		State that the path terminators define a specific type of termination of the previous flight path.	X		X			X		
(07)		Define 'offset flight path'.	X		X			X	X	
062 07 03 04		**Intentionally left blank**								
062 07 04 00		**Performance-based navigation (PBN) operations**								
062 07 04 01		**Performance-based navigation (PBN) principles**								
(01)		Define 'path definition error' (PDE).	X		X			X	X	
(02)		Define 'flight technical error' (FTE) and state that the FTE is the error in following the prescribed path, either by the auto-flight system or by the pilot.	X		X			X	X	
(03)		Define 'navigation system error' (NSE) and state that the accuracy of a navigation system may be referred to as NSE.	X		X			X	X	
(04)		Define 'total system error' (TSE) and state that the geometric sum of the PDE, FTE and NSE equals the TSE.	X		X			X	X	
(05)		State that navigation accuracy depends on the TSE.	X		X			X		
062 07 04 02		**On-board performance monitoring and alerting**								
(01)		State that on-board performance monitoring and alerting of flight technical errors is managed by on-board systems or flight crew procedures.	X		X			X	X	
(02)		State that on-board performance monitoring and alerting of navigation system errors is a requirement of on-board equipment for RNP.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		State that, dependent on the navigation sensor, the estimated position error (EPE) is compared with the required navigation specification.	X		X			X		
(04)		Explain how a navigation system assesses the EPE.	X		X			X		
(05)		Give an example of how the loss of the ability to operate in RNP airspace may be indicated by the navigation system.	X		X			X		
(06)		State that on-board performance monitoring and alerting of path definition error is managed by gross reasonableness checks of navigation data.	X		X			X	X	
062 07 04 03		**Abnormal situations**								
(01)		State that abnormal and contingency procedures are to be used in case of loss of the PBN capability.	X		X			X	X	
062 07 04 04		**Database management**								
(01)		State that, unless otherwise specified in the operations documentation or acceptable means of compliance (AMCs), the navigational database must be valid for the current aeronautical information regulation and control (AIRAC) cycle.	X		X			X	X	
062 07 05 00		**Requirements of specific RNAV and RNP specifications**								
062 07 05 01		**RNAV 10**								
(01)		State that RNAV 10 requires that aircraft operating in oceanic and remote areas be equipped with at least two independent and serviceable long-range navigation systems (LRNSs) comprising an INS, an	X		X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		inertial reference system (IRS)/flight management system (FMS) or a GNSS.								
(02)		State that operators may extend their RNAV 10 navigation capability time by updating.	X		X			X		
062 07 05 02		**RNAV 5**								
(01)		State that manual data entry is acceptable for RNAV 5.	X		X			X	X	
062 07 05 03		**RNAV 1/RNAV 2/RNP 1/RNP 2**								
(01)		State that pilots must not fly an RNAV 1, RNAV 2, RNP 1 or RNP 2 standard instrument departure (SID) or standard instrument arrival (STAR) unless it is retrievable by route name from the onboard navigation database and conforms to the charted route.	X		X			X	X	
(02)		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	X	
(03)		State that the manual entry, or creation of new waypoints by manual entry, of either latitude and longitude or place/bearing/distance values is not permitted.	X		X			X	X	
062 07 05 04		**Intentionally left blank**								
062 07 05 05		**Required navigation performance approach (RNP APCH)**								
(01)		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	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		State that an RNP APCH to LNAV minima is a non-precision IAP designed for two-dimensional approach operations.	X		X			X	X	
(03)		State that an RNP APCH to lateral navigation (LNAV)/vertical navigation (VNAV) minima has lateral guidance based on GNSS and vertical guidance based on either SBAS or barometric vertical navigation (Baro-VNAV).	X		X			X	X	
(04)		State that an RNP APCH to LNAV/VNAV minima may only be conducted with vertical guidance certified for the purpose.	X		X			X	X	
(05)		Explain why an RNP APCH to LNAV/VNAV minima based on Baro-VNAV may only be conducted when the aerodrome temperature is within a promulgated range if the barometric input is not automatically temperature-compensated.	X		X			X	X	
(06)		State that the correct altimeter setting is critical for the safe conduct of an RNP APCH using Baro-VNAV.	X		X			X	X	
(07)		State that an RNP APCH to LNAV/VNAV minima is a three-dimensional operation.	X		X			X	X	
(08)		State that an RNP APCH to localiser performance with vertical guidance (LPV) minima is a three-dimensional operation.	X		X			X	X	
(09)		State that RNP APCH to LPV minima requires a final approach segment (FAS) data block.	X		X			X	X	
(10)		State that RNP approaches to LPV minima require SBAS.	X		X			X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(11)		State that the FAS data block is a standard data format to describe the final approach path.	X		X			X	X	
062 07 05 06		**Required navigation performance authorisation required approach (RNP AR APCH)**								
(01)		State that RNP AR APCH requires authorisation.	X		X			X	X	
062 07 05 07		**Advanced required navigation performance (A-RNP)**								
(01)		State that A-RNP incorporates the navigation specifications RNAV 5, RNAV 2, RNAV 1, RNP 2, RNP 1 and RNP APCH.	X		X			X		
062 07 05 08		**PBN point-in-space (PinS) departure**								
(01)		State that a PinS departure is a departure procedure designed for helicopters only.			X			X		
(02)		State that a PinS departure procedure includes either a ‘proceed VFR’ or a ‘proceed visually’ instruction from the landing location to the initial departure fix (IDF).			X			X		
(03)		Recognise the differences in the instructions ‘proceed VFR’ and ‘proceed visually’.			X			X		
062 07 05 09		**PBN point-in-space (PinS) approach**								
(01)		State that a PinS approach procedure is an instrument RNP APCH procedure designed for helicopters only, and that it may be published with LNAV minima or LPV minima.			X			X		
(02)		State that a PinS approach procedure includes either a ‘proceed VFR’ or a ‘proceed visually’ instruction from the			X			X		

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		missed approach point (MAPt) to a landing location.								
(03)		Recognise the differences between ‘proceed VFR’ and ‘proceed visually’.			X			X		

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SUBJECT 070 – OPERATIONAL PROCEDURES

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			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**								
(01)		Define the following: alternate aerodrome: flight time (aeroplanes); take-off alternate; en-route alternate; destination alternate. **Source: ICAO Annex 6, Part I, Chapter 1**	X	X						
(02)		Define 'alternate heliport'; 'flight time (helicopters)'. **Source: ICAO Annex 6, Part III, Section 1, Chapter 1**			X	X	X			
071 01 01 02		**Applicability**								
(01)		State that Part I shall be applicable to the operation of aeroplanes by operators authorised to conduct international commercial air transport (CAT) operations. **Source: ICAO Annex 6, Part I, Chapter 2**	X	X						
(02)		State that Part III shall be applicable to all helicopters engaged in international CAT operations or in international general aviation operations, except helicopters engaged in aerial work. **Source: ICAO Annex 6, Part III, Section 1, Chapter 2**			X	X	X			
071 01 01 03		**General**								
(01)		Explain the compliance with laws, regulations and procedures. **Source: ICAO Annex 6, Part I, Chapter 3.1; ICAO Annex 6, Part III, Section 2, Chapter 1.1**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		State the condition(s) required for the establishment of a flight data analysis programme, and state what this programme is part of. **Source: ICAO Annex 6, Part I, Chapter 3.3**	X	X	X	X	X			
(03)		Explain what is a flight safety documents system. **Source: ICAO Annex 6, Part I, Chapter 3.3**	X	X	X	X	X			
(04)		Explain what is maintenance release. **Source:** **ICAO Annex 6, Part I, Chapter 8.8; ICAO Annex 6 Part III, Section 2, Chapter 6.7**	X	X	X	X	X			
(05)		List and describe the lights to be displayed by aircraft. **Source: ICAO Annex 6, Part I, Appendix 1: 2. Navigation lights to be displayed in the air**	X	X	X	X	X			
071 01 02 00		**Operational requirements**								
071 01 02 01		**Applicability**								
(01)	X	State the operational regulations applicable to CAT and other activities (e.g. specialised operations (SPO)). **Source:** **Regulation (EU) No 965/2012 on air operations;** **Regulation (EU) No 1178/2011 on aircrew requirements**	X	X	X	X	X			
(02)		State the nature of CAT operations and exceptions. **Source: Regulation (EU) No 965/2012: Articles 1 and 5, points ORO.GEN.005**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		'Scope' and CAT.GEN.100 'Competent authority'; **Regulation (EU) 2018/1139: Article 2**								
071 01 02 02		**General**								
(01)	X	Explain why CAT flights must meet the applicable operational requirements. **Source:** **Point ORO.GEN.105 'Competent authority' and related AMCs/GM;** **Point ORO.GEN.110 'Operator responsibilities' and related AMCs/GM**	X	X	X	X	X			
(02)		Define 'flight manual limitations — flight through the height velocity (HV) envelope'.			X	X	X			
(03)		Define 'helicopter emergency medical service (HEMS)'.			X	X	X			
(04)		Define 'operations over a hostile environment — applicability'. Explain that there are certain areas which should not be overflown and state possible sources of that information (e.g. governmental warnings, operator risk assessment).			X	X	X			
(05)		Define 'local area operations — approval'.			X	X	X			
(06)		Explain the requirements about language used for crew communication and in the operations manual. **Source: Point CAT.GEN.MPA.120 'Common language'**	X	X	X	X	X			
(07)		Explain which are the operator requirements regarding the management system. **Source:** **Point ORO.GEN.200 'Management system';**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		AMCs/GM to ORO.GEN.205 'Contracted activities' and to ORO.GEN.220 'Record-keeping'								
(08)		Explain which are the operator requirements regarding accident prevention and the flight safety programme. **Source: Point ORO.GEN.200 'Management system';** **AMCs/GM to ORO.GEN.205 'Contracted activities', to ORO.GEN.220 'Record-keeping', and to ORO.AOC.130 'Flight data monitoring — aeroplanes'**	X	X	X	X	X			
(09)		Explain which are the regulations concerning the carriage of persons on an aircraft. **Source: Point CAT.GEN.MPA.165 'Method of carriage of persons'**	X	X	X	X	X			
(10)		Explain the operator's and commander's responsibility concerning portable electronic devices (PEDs). **Source: Point CAT.GEN.MPA.140 'Portable electronic devices'**	X	X	X	X	X			
(11)		Explain the operator's and commander's responsibility regarding admission in an aircraft of a person under the influence of drug or alcohol. **Source: Point CAT.GEN.MPA.170 'Alcohol and drugs'**	X	X	X	X	X			
(12)		Explain the regulations concerning the endangerment of safety. **Source: Point CAT.GEN.MPA.175 'Endangering safety'**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(13)		List the documents to be carried on each flight. **Source: Point CAT.GEN.MPA.180 'Documents, manuals and information to be carried' and related AMCs/GM**	X	X	X	X	X			
(14)		Explain the operator's responsibility regarding manuals to be carried on board an aircraft. **Source: Point CAT.GEN.MPA.180 'Documents, manuals and information to be carried' and related AMCs/GM**	X	X	X	X	X			
(15)		List the additional information and forms to be carried on board an aircraft. **Source: Point CAT.GEN.MPA.180 'Documents, manuals and information to be carried on board an aircraft' and related AMCs/GM**	X	X	X	X	X			
(16)		List the copies of items of information to be retained on the ground by the operator. **Source: Point CAT.GEN.MPA.185 'Information to be retained on the ground'**	X	X	X	X	X			
071 01 02 03		**Operator certification and supervision**								
(01)		Explain what requirement has to be satisfied for the issue of an air operator certificate (AOC). **Source:** **Point ARO.OPS.100 'Issue of the air operator certificate';** **Point ORO.GEN.210 'Personnel requirements';** **Point ORO.AOC.100 'Application for an air operator certificate'**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain what the rules applicable to air operator certification are. **Source:** **Point ORO.AOC.100 'Application for an air operator certificate';** **Point ORO.AOC.105 'Operations specifications and privileges of an AOC holder'**	X	X	X	X	X			
(03)		Explain the conditions to be met for the issue or revalidation of an AOC. **Source: ARO.GEN.310 'Initial certification procedure — organisations'**	X	X	X	X	X			
(04)		Explain the contents and conditions of the AOC. **Source: Regulation (EU) No 956/2012, Appendix I 'Air Operator Certificate**	X	X	X	X	X			
071 01 02 04		**Operational procedures (except preparation for long-range flight)**								
(01)		Define the terms used for operational procedures. **Source:** **Point CAT.OP.MPA.106 'Use of isolated aerodromes — aeroplanes';** **Point CAT.OP.MPA.107 'Adequate aerodrome'**	X	X						
(02)		State the operator's responsibilities regarding the use of air traffic services (ATS). **Source: Point CAT.OP.MPA.100 'Use of air traffic services'**	X	X	X	X	X			
(03)		State the operator's responsibilities regarding authorisation of	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		aerodromes/heliports by the operator. **Source:** **Point CAT.OP.MPA.105 'Use of aerodromes and operating sites';** **Point CAT.OP.MPA.106 'Use of isolated aerodromes — aeroplanes';** **Point CAT.OP.MPA.107 'Adequate aerodrome'**								
(04)		Explain which elements must be considered by the operator when specifying aerodrome/heliport operating minima. **Source:** **Point CAT.OP.MPA.110 (a) and (c) 'Aerodrome operating minima',** **Point CAT.OP.MPA.115 'Approach flight technique - aeroplanes',** **Point SPA.LVO.100 'Low visibility operations' and related AMCs/GM;** **Point SPA.LVO.110 'General operating requirements'**	X	X	X	X	X			
(05)		Explain what the operator's responsibilities are regarding departure and approach procedures. **Source: Point CAT.OP.MPA.125 'Instrument departure and approach procedures'**	X	X	X	X	X			
(06)		Explain which parameters should be considered in noise- abatement procedures. **Source:** **Point CAT.OP.MPA.130 'Noise abatement procedures — aeroplanes';** **AMC1 CAT.OP.MPA.130;**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		GM1 CAT.OP.MPA.130								
(07)		Explain which elements should be considered regarding routes and areas of operation. **Source:** **Point CAT.OP.MPA.135 'Routes and areas of operation — general';** **Point CAT.OP.MPA.136 'Routes and areas of operation — single-engined aeroplanes'**	X	X	X	X	X			
(08)		Explain the requirements for flights in reduced vertical separation minima (RVSM) airspace. **Source:** **Point SPA.RVSM.100 'RVSM operations';** **Point SPA.RVSM.105 'RVSM operational approval';** **Point SPA.RVSM.110 'RVSM equipment requirements' and AMC1 SPA.RVSM.110(a);** **Point SPA.RVSM.115 'RVSM height-keeping errors'**	X	X						
(09)		List the factors to be considered when establishing minimum flight altitude. **Source:** **Point CAT.OP.MPA.145 'Establishment of minimum flight altitudes' and related AMCs/GM;** **AMC1 CAT.OP.MPA.145(a); AMC1.1 CAT.OP.MPA.145(a)**	X	X	X	X	X			
(10)		Explain the requirements for carrying persons with reduced mobility. **Source: Point CAT.OP.MPA.155**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		'Carriage of special categories of passengers (SCPs)'								
(11)		Explain the operator's responsibilities for the carriage of inadmissible passengers, deportees or persons in custody. **Source: Point CAT.OP.MPA.155 'Carriage of special categories of passengers (SCPs)**'	X	X	X	X	X			
(12)		Explain the requirements regarding passenger seating and emergency evacuation. **Source: Point CAT.OP.MPA.165 'Passenger seating' and related AMCs/GM**	X	X	X	X	X			
(13)		Detail the procedures for passenger briefing in respect of emergency equipment and exits. **Source: Point CAT.OP.MPA.170 'Passenger briefing'; AMC1 CAT.OP.MPA.170; AMC2 CAT.OP.MPA.170**	X	X	X	X	X			
(14)		State the flight preparation forms to be completed before flight. **Source: Point CAT.OP.MPA.175 'Flight preparation' and related AMCs/GM; AMC1 CAT.OP.MPA.175(a)**	X	X	X	X	X			
(15)		State the commander's responsibilities during flight preparation. **Source: Point CAT.OP.MPA.175 'Flight preparation'**	X	X	X	X	X			
(16)		State the rules for aerodrome/heliport selection. **Source:**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes'; Point CAT.OP.MPA.181 'Selection of aerodromes and operating sites — helicopters'								
(17)		Explain the planning minima for instrument flight rule (IFR) flights. **Source: Point CAT.OP.MPA.185 'Planning minima for IFR flights — aeroplanes'**	X		X					
(18)		Explain the rules for refuelling/defueling with passengers on board. **Source: Point CAT.OP.MPA.195 'Refuelling/defuelling with passengers embarking, on board or disembarking' and related AMCs; AMC1 CAT.OP.MPA.195; Point CAT.OP.MPA.200 'Refuelling/ defuelling with wide-cut fuel' and related AMCs; GM1 CAT.OP.MPA.200**	X	X	X	X	X			
(19)		Explain the 'crew members at station' policy. **Source: CAT.OP.MPA.210 'Crew members at stations' and related AMCs; AMC1 CAT.OP.MPA.210(b); GM1 CAT.OP.MPA.210**	X	X	X	X	X			
(20)		Explain the use of seats, safety belts and harnesses. **Source: Point CAT.OP.MPA.225 'Seats, safety belts and restraint systems'**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(21)		Explain the requirements for securing passenger cabin and galley. **Source: Point CAT.OP.MPA.230 'Securing of passenger compartment and galley(s)**'	X	X	X	X	X			
(22)		Explain the commander's responsibility regarding smoking on board. **Source: Point CAT.OP.MPA.240 'Smoking on board'**	X	X	X	X	X			
(23)		State under which conditions a commander can commence or continue a flight regarding meteorological conditions. **Source: Point CAT.OP.MPA.245 'Meteorological conditions — all aircraft'; Point CAT.OP.MPA.246 'Meteorological conditions — aeroplanes'; Point CAT.OP.MPA.265 'Take-off conditions'**	X	X	X	X	X			
(24)		Explain the commander's responsibility regarding ice and other contaminants. **Source: Point CAT.OP.MPA.250 'Ice and other contaminants — ground procedures' and related AMCs/GM; Point CAT.OP.MPA.255 'Ice and other contaminants — flight procedures' and related AMCs/GM; GM1 CAT.OP.MPA.250 (a) to (l); GM2 CAT.OP.MPA.250 (a) to (f); GM3 CAT.OP.MPA.250 (a)(1) to (3); AMC1 CAT.OP.MPA.255 (a)**	X	X	X	X	X			
(25)		Explain the commander's responsibility regarding fuel to be carried and in-flight fuel management.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Point CAT.OP.MPA.260 'Fuel and oil supply'; Point CAT.OP.MPA.280 'In-flight fuel management — aeroplanes'; Point CAT.OP.MPA.281 'In-flight fuel management — helicopters' and AMC1 CAT.OP.MPA.281								
(26)		Detail the rules regarding carriage and use of supplemental oxygen for passengers and aircrew. **Source: Point CAT.OP.MPA.285 'Use of supplemental oxygen'; Point CAT.IDE.A.235 'Supplemental oxygen — pressurised aeroplanes' and related AMCs/GM**	X	X	X	X	X			
		Flight preparation								
(27)		Explain the commander's responsibility regarding approach and landing. **Source: Point CAT.OP.MPA.300 'Approach and landing conditions' and AMC1 CAT.OP.MPA.300; Point CAT.OP.MPA.305 'Commencement and continuation of approach' and related AMCs/GM**	X	X	X	X	X			
(28)		Explain the circumstances under which a report shall be submitted. **Source: Point ORO.GEN.160 'Occurrence reporting' and related AMCs/GM**	X	X	X	X	X			
071 01 02 05		**All-weather operations**								
(01)		Explain the operator's responsibility regarding aerodrome/heliport operating minima.	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Point CAT.OP.MPA.110 'Aerodrome operating minima' and related AMCs/GM; Point CAT.OP.MPA.115 'Approach flight technique — aeroplanes' and related AMCs/GM								
(02)		Define the following terms: 'circling', 'low-visibility procedures', 'low-visibility take-off', 'visual approach'. **Source: Regulation (EU) No 965/2012, Annex I**	X		X					
(03)		Define the following terms: 'flight control system', 'fail-passive flight control system', 'fail-operational flight control system', 'fail-operational hybrid landing system'. **Source: Regulation (EU) No 965/2012, Annex I**	X							
(04)		Define the following terms: 'final approach and take-off area'. **Source: Regulation (EU) No 965/2012, Annex I**			X					
(05)		Explain the general operating requirements for low-visibility operations. **Source: Point SPA.LVO.100 'Low visibility operations' and related AMCs; Point SPA.LVO.105 'LVO approval'; Point SPA.LVO.110 'General operating requirements'; Point SPA.LVO.115 'Aerodrome related requirements'**	X		X					
(06)		Define aerodrome/heliport considerations regarding low-visibility operations. **Source: SPA.LVO.115 'Aerodrome related requirements'**	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the training and qualification requirements for flight crew to conduct low-visibility operations. **Source: Point SPA.LVO.120 'Flight crew training and qualifications' and related AMCs**	X		X					
(08)		Explain the operating procedures for low-visibility operations. **Source: Point SPA.LVO.125 'Operating procedures and AMC1 SPA.LVO.125**	X		X					
(09)		Explain the operator's and commander's responsibilities regarding minimum equipment for low-visibility operations. **Source: Point SPA.LVO.130 'Minimum equipment'**	X		X					
(10)		Explain the VFR operating minima. **Source: AMC12 CAT.OP.MPA.110 'Aerodrome operating minima — VFR OPERATIONS WITH OTHER-THAN-COMPLEX MOTOR-POWERED AIRCRAFT'**	X		X					
(11)		Aerodrome operating minima: explain under which conditions the commander can commence take-off. **Source: Point CAT.OP.MPA.110 'Aerodrome operating minima' and related AMCs/GM; Point SPA.LVO.110 'General operating requirements' and related AMCs/GM**	X		X					
(12)		Aerodrome operating minima: explain that take-off minima are expressed as visibility or runway visual range (RVR). **Source: Point CAT.OP.MPA.110 'Aerodrome operating minima'; AMC1**	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		CAT.OP.MPA.110; AMC2 CAT.OP.MPA.110								
(13)		Aerodrome operating minima: explain the take-off RVR value depending on the aerodrome facilities. **Source: AMC1 CAT.OP.MPA.110 'Aerodrome operating minima', Table 1.A; AMC2 CAT.OP.MPA.110 'Aerodrome operating minima', Table 1.H**	X		X					
(14)		Aerodrome operating minima: explain the system minima for non-precision approach (NPA) (minimum descent altitude/height (MDA/H) and decision altitude/height (DA/H), not RVR). **Source: AMC3 CAT.OP.MPA.110 'Aerodrome operating minima' (Table 3: ILS/MLS/GLS; SRA 1NM; VOR; NDB); AMC6 CAT.OP.MPA.110 'Aerodrome operating minima'**	X		X					
(15)		Aerodrome operating minima: explain under which conditions a pilot can continue the approach below MDA/H or DA/H. **Source: Point CAT.OP.MPA.305 'Commencement and continuation of approach'; AMC1 CAT.OP.MPA.305(e)**	X		X					
(16)		Aerodrome operating minima: explain the lowest minima for precision approach category 1 (including single-pilot operations). Source: AMC3 SPA.LVO.100 'Low visibility operations'	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(17)		Aerodrome operating minima: explain the lowest minima for precision approach category 2 operations. Source: AMC4 SPA.LVO.100 'Low visibility operations'	X		X					
(18)		Aerodrome operating minima: explain the lowest minima for precision approach category 3 operations. **Source: AMC5 SPA.LVO.100 'Low visibility operations'**	X							
(19)		Aerodrome operating minima: explain the lowest minima for circling and visual approach. **Source: AMC7 CAT.OP.MPA.110 'Aerodrome operating minima'; AMC9 CAT.OP.MPA.110; AMC8 CAT.OP.MPA.110**	X		X					
(20)		Aerodrome operating minima: explain the RVR value and cloud ceiling depending on the aerodrome. **Source: Point CAT.OP.MPA.110 'Aerodrome operating minima' and related AMCs/GM; Point SPA.LVO.110 'General operating requirements' and related AMCs**	X		X					
(21)		Aerodrome operating minima: explain under which conditions an airborne radar approach can be performed and state the relevant minima. **Source: Point CAT.OP.MPA.120 'Airborne radar approaches (ARAs) for overwater operations — helicopters'; AMC1 SPA.HOFO.120 'Selection of aerodromes and operating sites —**			X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		COASTAL AERODROME'; AMC2 SPA.HOFO.120 'Selection of aerodromes and operating sites — OFFSHORE DESTINATION ALTERNATE AERODROME'; AMC1 SPA.HOFO.125 'Airborne radar approach (ARA) to offshore locations — GENERAL'; GM1 SPA.HOFO.125 'Airborne radar approach (ARA) to offshore locations — GENERAL'; GM2 SPA.HOFO.125 'Airborne radar approach (ARA) to offshore locations — GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)/AREA NAVIGATION SYSTEM'								
071 01 02 06		**Instruments and equipment**								
(01)		Explain which items do not require an equipment approval. **Source: Point CAT.IDE.A.100 'Instruments and equipment — general' and related GM, and point CAT.IDE.H.100 'Instruments and equipment — general'; Points CAT.IDE.A.105/CAT.IDE.H.105 'Minimum equipment for flight'**	X	X	X	X	X			
(02)		Explain the requirements regarding availability of spare electrical fuses. **Source: Point CAT.IDE.A.110 'Spare electrical fuses' and related GM**	X	X	X	X	X			
(03)		Explain the requirements regarding windshield wipers. Source: Point CAT.IDE.A.120 'Equipment to clear windshield' and related AMCs	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		List the minimum equipment required for day and night VFR flights. **Source: Point CAT.IDE.A.125 'Operations under VFR by day' and related AMCs/GM**	X	X	X	X	X			
(05)		List the minimum equipment required for IFR flights. **Source: Point CAT.IDE.A.130 'Operations under IFR or at night — flight and navigational instruments and associated equipment' and related AMCs/GM; Point CAT.IDE.H.130 'Operations under IFR or at night — flight and navigational instruments and associated equipment' and related AMCs/GM**	X		X					
(06)		Explain the required additional equipment for single-pilot operations under IFR. Source: Points CAT.IDE.A.135/CAT.IDE.H.135 'Additional equipment for single-pilot operation under IFR'	X		X					
(07)		State the requirements for an altitude alerting system. **Source: Point CAT.IDE.A.140 'Altitude alerting system'**	X	X						
(08)		State the requirements for radio altimeters. **Source: Point CAT.IDE.H.145 'Radio altimeters'**			X	X	X			
(09)		State the requirements for ground proximity warning system (GPWS)/terrain awareness and warning system (TAWS).	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Point CAT.IDE.A.150 'Terrain awareness warning system (TAWS)'								
(10)		State the requirements for airborne collision avoidance system (ACAS). **Source: Point CAT.IDE.A.155 'Airborne collision avoidance system (ACAS)'**	X	X	X	X	X			
(11)		State the conditions under which an aircraft must be fitted with a weather radar. **Source:** **Points CAT.IDE.A.160/CAT.IDE.H.160 'Airborne weather detecting equipment'**	X	X	X	X	X			
(12)		State the circumstances under which a cockpit voice recorder (CVR) is compulsory (after 1998). **Source:** **Points CAT.IDE.A.185/CAT.IDE.H.185 'Cockpit voice recorder'**	X	X	X	X	X			
(13)		State the rules regarding the location, construction, installation, and operation of cockpit voice recorders (CVRs) (after 1998). **Source:** **Points CAT.IDE.A.185/CAT.IDE.H.185 'Cockpit voice recorder'**	X	X	X	X	X			
(14)		State the circumstances under which a flight data recorder (FDR) is compulsory (after 1998). **Source:** **Points CAT.IDE.A.190/CAT.IDE.H.190 'Flight data recorder'**	X	X	X	X	X			
(15)		State the rules regarding the location, construction, installation, and operation of flight data recorders (FDRs) (after 1998).	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: **Points CAT.IDE.A.190/CAT.IDE.A.190 'Flight data recorder' and related AMCs/GM**								
(16)		Explain the requirements about seats, seat safety belts, harnesses, and child-restraint devices. Source: **Points CAT.IDE.A.205/CAT.IDE.H.205 'Seats, seat safety belts, restraint systems and child restraint devices' and related AMCs/GM**	X	X	X	X	X			
(17)		Explain the requirements about 'Fasten seat belt' and 'No smoking' signs. Source: **Points CAT.IDE.A.210/CAT.IDE.H.210 'Fasten seat belt and no smoking signs'**	X	X	X	X	X			
(18)		Explain the requirements regarding internal doors and curtains. **Source: Point CAT.IDE.A.215 'Internal doors and curtains'**	X	X						
		First-aid and emergency equipment								
(19)		Explain the requirements regarding first-aid kits. **Source:** **Points CAT.IDE.A.220/CAT.IDE.H.220 'First-aid kit' and related AMCs/GM**	X	X	X	X	X			
(20)		Explain the requirements regarding emergency medical kits and first-aid oxygen. **Source:** **Point CAT.IDE.A.225 'Emergency medical kit';** **AMC1 CAT.IDE.A.225;**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		AMC2 CAT.IDE.A.225; **AMC3 CAT.IDE.A.225;** **AMC4 CAT.IDE.A.225;** **GM1 CAT.IDE.A.225;** **Point CAT.IDE.A.230 'First-aid oxygen'**								
(21)		Detail the rules regarding crew protective breathing equipment. **Source: Point CAT.IDE.A.245 'Crew protective breathing equipment'; AMC1 CAT.IDE.A.245**	X	X						
(22)		Describe the type and location of handheld fire extinguishers. **Source:** **Points CAT.IDE.A.250/CAT.IDE.H.250 'Hand fire extinguishers' and related AMCs/GM**	X	X	X	X	X			
(23)		Describe the location of crash axes and crowbars. **Source:** **Point CAT.IDE.A.255 'Crash axe and crowbar'; AMC1 CAT.IDE.A.255**	X	X						
(24)		Specify the colours and markings used to indicate break-in points. **Source:** **Points CAT.IDE.A.260/CAT.IDE.H.260 'Marking of break-in points' and related AMCs/GM**	X	X	X	X	X			
(25)		Explain the requirements for means of emergency evacuation. **Source: Point CAT.IDE.A.265 'Means for emergency evacuation'**	X	X						
(26)		Explain the requirements for megaphones. **Source:**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Points CAT.IDE.A.270/CAT.IDE.H.270 'Megaphones' and related AMCs/GM								
(27)		Explain the requirements for emergency lighting and marking. **Source:** **Points CAT.IDE.A.275/CAT.IDE.H.275 'Emergency lighting and marking**	X	X	X	X	X			
(28)		Explain the requirements for an emergency locator transmitter (ELT). **Source:** **Points CAT.IDE.A.280/CAT.IDE.H.280 'Emergency locator transmitter (ELT)' and related AMCs/GM**	X	X	X	X	X			
(29)		Explain the requirements for life jackets, life rafts, survival kits, and ELTs. **Source:** **Point CAT.IDE.A.285 'Flight over water';** **Point CAT.IDE.A.305 'Survival equipment'** **Point CAT.IDE.H.280 'Emergency locator transmitter (ELT)';** **Point CAT.IDE.H.290 'Life-jackets';** **Point CAT.IDE.H.295 'Crew survival suits';** **Point CAT.IDE.H.300 'Life-rafts, survival ELTs and survival equipment on extended overwater flights'**	X	X	X	X	X			
(30)		Explain the requirements for crew survival suit. **Source: Point CAT.IDE.H.295 'Crew survival suits'; GM1 CAT.IDE.H.295**			X	X	X			
(31)		Explain the requirements for survival equipment.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: **Points CAT.IDE.A.305/CAT.IDE.H.305 'Survival equipment'**								
(32)		Explain the additional requirements for helicopters operating to or from helidecks located in hostile sea areas. Source: **Point CAT.IDE.H.310 'Additional requirements for helicopters conducting offshore operations in a hostile sea area'**			X	X	X			
(33)		Explain the requirements for emergency flotation equipment. Source: **Point CAT.IDE.H.315 'Helicopters certified for operating on water — miscellaneous equipment'; Point CAT.IDE.H.320 'All helicopters on flights over water — ditching'**			X	X	X			
071 01 02 07		**Communication and navigation equipment**								
(01)		Explain the general requirements for communication and navigation equipment. **Source: Point CAT.IDE.A.325 'Headset' and related AMCs/GM**	X	X	X	X	X			
(02)		Explain why the radio-communication equipment must be able to send and receive on 121.5 MHz. **Source:** **Points CAT.IDE.A.330/CAT.IDE.H.330 'Radio communication equipment'**	X	X	X	X	X			
(03)		Explain the requirements regarding the provision of an audio selector panel. **Source:**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Points CAT.IDE.A.335/CAT.IDE.H.335 'Audio selector panel'								
(04)		List the requirements for radio equipment when flying under VFR by reference to visual landmarks. **Source:** **Points CAT.IDE.A.340/CAT.IDE.H.340 'Radio equipment for operations under VFR over routes navigated by reference to visual landmarks'**	X	X	X	X	X			
(05)		List the requirements for communication and navigation equipment when operating under IFR or under VFR over routes not navigated by reference to visual landmarks. **Source:** **Points CAT.IDE.A.345/CAT.IDE.H.345 'Communication and navigation equipment for operations under IFR or under VFR over routes not navigated by reference to visual landmarks'**	X	X	X	X	X			
(06)		Explain what equipment is required to operate in airspace with reduced vertical separation minima (RVSM). **Source: Point SPA.RVSM.110 'RVSM equipment requirements'**	X	X						
(07)		Explain the conditions under which a crew member interphone system and public address system are mandatory. **Source:** **Points CAT.IDE.A.170/CAT.IDE.H.170 'Flight crew interphone system';** **AMC1 CAT.IDE.A.170/CAT.IDE.H.170;**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Points CAT.IDE.A.175/CAT.IDE.H.175 'Crew member interphone system'; AMC1 CAT.IDE.A.175/CAT.IDE.H.175; Points CAT.IDE.A.180/CAT.IDE.H.180 'Public address system'; AMC1 CAT.IDE.A.180/CAT.IDE.H.180								
(08)		List the equipment for operations requiring a radio communication. **Source: Point CAT.IDE.H.325 'Headset'; Point CAT.IDE.H.330 'Radio communication equipment'; Point CAT.IDE.H.335 'Audio selector panel'; Point CAT.IDE.H.340 'Radio equipment for operations under VFR over routes navigated by reference to visual landmarks'**			X	X	X			
(09)		List the equipment for operations that require a radio navigation system. **Source: Point CAT.IDE.H.325 'Headset'; AMC1 CAT.IDE.H.325; Point CAT.IDE.H.345 'Communication and navigation equipment for operations under IFR or under VFR over routes not navigated by reference to visual landmarks'**			X	X	X			
(10)		Explain the requirements regarding the provision of a transponder. Source: Points CAT.IDE.A.350/CAT.IDE.H.350 'Transponder'; AMC1 CAT.IDE.A.350/CAT.IDE.H.350	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(11)		Explain the requirements regarding the management of aeronautical databases. **Source:** **Point CAT.IDE.A.355 'Management of aeronautical databases';** **AMC1 CAT.IDE.A.355 'Management of aeronautical databases — AERONAUTICAL DATABASES'**	X	X						
071 01 02 08		**Intentionally left blank**								
071 01 02 09		**Flight crew**								
(01)		Explain the requirement regarding flight crew composition and in-flight relief. **Source:** **Point ORO.FC.100 'Composition of flight crew; AMC1 ORO.FC.100(c);** **Point ORO.FC.105 'Designation as pilot-incommand/commander';** **AMC1 ORO.FC.105(b)(2);(c);** **GM1 ORO.FC.105 (b)(2);** **AMC1 ORO.FC.105(c);** **Point ORO.FC.110 'Flight engineer';** **Point ORO.FC.115 'Crew resource management (CRM) training';** **Point ORO.FC.200 'Composition of flight crew';** **AMC1 ORO.FC.200(a);** **Point ORO.FC.A.201 'In-flight relief of flight crew members';** **Point ORO.FC.202 Single-pilot operations under IFR or at night**	X	X	X	X	X			
(02)		Explain the requirement for conversion training and checking. **Source:**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point ORO.FC.120 'Operator conversion training'; **Point ORO.FC.145 'Provision of training';** **Point ORO.FC.220 'Operator conversion training and checking'; and related AMCs/GM**								
(03)		Explain the requirement for differences training and familiarisation training. **Source:** **Point ORO.FC.125 'Differences training and familiarisation training';** **AMC1 ORO.FC.125**	X	X	X	X	X			
(04)		Explain the conditions for upgrade from co-pilot to commander. **Source: Point ORO.FC.205 'Command course'**	X	X	X	X	X			
(05)		Explain the minimum qualification requirements to operate as a commander. **Source:** **Point ORO.FC.A.250 'Commanders holding a CPL(A)'**	X	X	X	X	X			
(06)		Explain the requirement for recurrent training and checking. **Source: Point ORO.FC.230 'Recurrent training and checking'**	X	X	X	X	X			
(07)		Explain the requirement for a pilot to operate on either pilot's seat. **Source:** **Point ORO.FC.235 'Pilot qualification to operate in either pilot's seat';** **AMC1 ORO.FC.235(d);** **GM1 ORO.FC.235(f);(g)**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Explain the minimum recent experience requirements for the commander and the co-pilot. **Source:** **Point FCL.060 'Recent experience';** **AMC1 FCL.060(b)(1);** **GM1 FCL.060(b)(1)**	X	X	X	X	X			
(09)		Specify the route and aerodrome/heliport knowledge required for a PIC/commander. **Source:** **Point ORO.FC.105 'Designation as pilot-in-command/ commander';** **AMC1 ORO.FC.105(b)(2);(c);** **GM1 ORO.FC.105(b)(2);** **AMC1 ORO.FC.105(c)**	X	X	X	X	X			
(10)		Explain the requirement to operate on more than one aircraft type or variant. **Source:** **Point ORO.FC.140 'Operation on more than one type or variant';** **Point ORO.FC.240 'Operation on more than one type or variant';** **AMC1 ORO.FC.240(a)(1)**	X	X	X	X	X			
(11)		Explain that when a flight crew member operates both helicopters and aeroplanes, the operations are limited to one of each type. **Source: Point ORO.FC.240 'Operation on more than one type or variant'**	X	X	X	X	X			
(12)		Explain the requirement(s) for training records. **Source: Point ORO.MLR.115 'Record-keeping'**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(13)		Explain the crew members' responsibilities in the execution of their duties, and define the commander's authority. **Source:** **Point CAT.GEN.MPA.100 'Crew responsibilities;** **Point CAT.GEN.MPA.105 'Responsibilities of the commander;** **Point CAT.GEN.MPA.110 'Authority of the commander'**	X	X	X	X	X			
(14)		Explain the operator's and commander's responsibilities regarding persons on board, admission to the flight crew compartment and carriage of unauthorised persons or cargo. **Source:** **Point CAT.GEN.MPA.135 'Admission to the flight crew compartment;** **Point CAT.GEN.MPA.165 'Method of carriage of persons;** **Point CAT.GEN.MPA.105 'Responsibilities of the commander'**	X	X	X	X	X			
(15)		Explain the requirements for the initial operator's crew resource management (CRM) training. **Source: Point ORO.FC.215 'Initial operator's crew resource management (CRM) training'**	X	X	X	X	X			
071 01 02 10		**Cabin crew/crew members other than flight crew**								
(01)		Explain who is regarded as cabin crew member.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Regulation (EU) No 965/2012, Annex I 'Definitions'								
(02)		Detail the requirements regarding the number and composition of cabin crew. **Source:** **Point ORO.CC.100 'Number and composition of cabin crew;** **AMC1 ORO.CC.100;** **GM1 ORO.CC.100;** **Point ORO.CC.205 'Reduction of the number of cabin crew during ground operations and in unforeseen circumstances'**	X	X	X	X	X			
(03)		Explain the conditions and the additional conditions for assignment to duties. **Source:** **Point ORO.CC.110 'Conditions for assignment to duties;** **Point ORO.CC.210 'Additional conditions for assignment to duties; GM1 ORO.CC.210(d)**	X	X	X	X	X			
(04)		Explain the requirements regarding senior cabin crew members. **Source: Point ORO.CC.200 'Senior cabin crew member; AMC1 ORO.CC.200(c);(d);(e)**	X	X	X	X	X			
(05)		Explain the conditions for operating on more than one aircraft type or variant. **Source:** **Point ORO.CC.250 'Operation on more than one aircraft type or variant;** **AMC1 ORO.CC.250(b);** **GM1 ORO.CC.250**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain what is the operator's responsibility regarding the distinction between cabin crew members and additional crew members. **Source:** **Point CAT.GEN.MPA.115 'Personnel or crew members other than cabin crew in the passenger compartment'**	X	X	X	X	X			
071 01 02 11		**Intentionally left blank**								
071 01 02 12		**Flight and duty time limitations and rest requirements**								
(01)		Explain the definitions used for the regulation of flight time limitations. **Source:** **Point ORO.FTL.100 'Scope';** **Point ORO.FTL.105 'Definitions' (values of Table 1 excluded)**	X	X						
(02)		Explain the flight and duty time limitations. **Source:** **Point ORO.FTL.200 'Home base';** **Point ORO.FTL.210 'Flight times and duty periods'**	X	X						
(03)		Explain the requirements regarding the maximum daily flight duty period. **Source:** **Point ORO.FTL.205 'Flight duty period (FDP)';** **Point ORO.FTL.205(b) 'Basic maximum daily FDP' (use of the tables but not memorisation)**	X	X						
(04)		Explain the requirements regarding rest periods. **Source: Point ORO.FTL.235 'Rest periods'**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Explain the possible extension of flight duty period due to inflight rest. **Source:** **Point ORO.FTL.205 'Flight duty period (FDP)';** **Point ORO.FTL.205(e) 'Maximum daily FDP with the use of extensions due to in-flight rest'**	X	X						
(06)		Explain that it is the captain's discretion to extend flight duty in case of unforeseen circumstances in actual flight operations. **Source:** **Point ORO.FTL.205 'Flight duty period (FDP)';** **Point ORO.FTL.205(f) 'Unforeseen circumstances in flight operations — commander's discretion'**	X	X						
(07)		Explain the requirement regarding standby. **Source: Point ORO.FTL.225 'Standby and duties at the airport'**	X	X						
071 01 03 00		**Long-range flights**								
071 01 03 01		**Flight management**								
(01)		Minimum time routes: define and interpret minimum time route (route that gives the shortest flight time from departure to destination adhering to all ATC and airspace restrictions). **Source: N/A**	X							
(02)		State the circumstances in which a take-off alternate must be selected. **Source:** **Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes;**	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point CAT.OP.MPA.181 'Selection of aerodromes and operating sites — helicopters'								
(03)		State the maximum flight distance of a take-off alternate for: — two-engined aeroplanes; — ETOPS-approved aeroplanes; — three- or four-engined aeroplanes. **Source:** **Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes';** **Point CAT.OP.MPA.181 'Selection of aerodromes and operating sites — helicopters'**	X		X					
(04)		State the factors to be considered in the selection of a take-off alternate. Source: Point CAT.OP.MPA.185 'Planning minima for IFR flights — aeroplanes'; Point CAT.OP.MPA.186 'Planning minima for IFR flights — helicopters'	X		X					
(05)		State when a destination alternate need not be selected. **Source:** **Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes';** **Point CAT.OP.MPA.181 'Selection of aerodromes and operating sites — helicopters'**	X		X					
(06)		State when two destination alternates must be selected. **Source:** **Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes';**	X		X					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point CAT.OP.MPA.181 'Selection of aerodromes and operating sites — helicopters'								
(07)		State the factors to be considered in the selection of a destination alternate aerodrome. **Source:** **Point CAT.OP.MPA.185 'Planning minima for IFR flights — aeroplanes';** **Point CAT.OP.MPA.186 'Planning minima for IFR flights — helicopters'**	X		X					
(08)		State the factors to be considered in the selection of an enroute alternate aerodrome. **Source:** **Point CAT.OP.MPA.185 'Planning minima for IFR flights — aeroplanes'**	X		X					
071 01 03 02		**Transoceanic and polar flights (ICAO Doc 7030 'Regional Supplementary Procedures — North Atlantic Operations and Airspace Manual')**								
(01)		According to ICAO Doc 7030, explain that special rules apply to the North Atlantic (NAT) Region, and crews need to be specifically trained before flying in this area. **Source: NAT 007, 1.3.8 Crew Training**	X							
(02)		Describe the possible indications of navigation system degradation, including any system-generated warning. **Source: NAT 007, Chapter 12 Procedures in the event of navigation system degradation or failure**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe by what emergency means course and inertial navigation system (INS) can be cross-checked in the case of three navigation systems and two navigation systems. **Source: NAT 007, Chapter 12 Procedures in the event of navigation system degradation or failure**	X							
(04)		Describe the general ICAO procedures applicable in NAT airspace if the aircraft is unable to continue the flight in accordance with its air traffic control (ATC) clearance. **Source: NAT 007, 13.2 General procedures**	X							
(05)		Describe the ICAO procedures applicable in NAT airspace in case of radio-communication failure. **Source: NAT 007, 6.6 HF Communications failure**	X							
(06)		Describe the recommended initial action if an aircraft is unable to obtain a revised ATC clearance. **Source: NAT 007, Chapter 13 Special procedures for in-flight contingencies**	X							
(07)		Describe the subsequent action for aircraft able to maintain assigned flight level and for aircraft unable to maintain assigned flight level. **Source: NAT 007, Chapter 13 Special procedures for in-flight contingencies**	X							
(08)		Describe determination of tracks and courses for random routes in NAT airspace.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: ICAO Doc 7030, NAT 2.1.9.1 General; NAT 007, 2.1.3; NAT 007, Chapter 4 Flight Planning								
(09)		Specify the method by which planned tracks are defined (by latitude and longitude) in the NAT airspace: when operating predominately in an east–west direction south of 70°N, and when operating predominately in an east–west direction north of 70°N. **Source: ICAO Doc 7030, NAT 2.1.9 Route; NAT 007, Chapter 4 (Flights Planning on Random Route Segments in a Predominantly East - West Direction)**	X							
(10)		State the maximum flight time recommended between significant points on random routes. **Source: ICAO Doc 7030, NAT 2.1.9 Route; NAT 007, Chapter 4 (Flights Planning on Random Route Segments in a Predominantly East - West Direction and Predominantly North - South Direction)**	X							
(11)		Specify the method by which planned tracks for random routes are defined for flights operating predominantly in a north–south direction. **Source: ICAO Doc 7030, NAT 2.1.9 Route; NAT 007, Chapter 4 (Flights Planning on Random Routes in a Predominantly North - South Direction)**	X							
(12)		Describe how the desired random route must be specified in the ATC flight plan.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: NAT 007, 4.2 Flight planning requirements on specific routes								
(13)		Describe what precautions can be taken when operating in the area of compass unreliability as a contingency against INS failure. **Source: NAT 007, Chapter 12 Procedures in the event of navigation system degradation or failure (not including detailed information on route structures and their coordinates); NAT 007, Chapter 8 (Master document — position plotting)**	X							
071 01 03 03		**North Atlantic High Level Airspace (NAT HLA)**								
		NAT Region North Atlantic Operations and Airspace Manual (NAT Doc 007 Version 2017-1 and NAT Doc 7030)								
(01)		State the lateral dimensions (in general terms) and vertical limits of the NAT HLA. **Source: NAT 007, 17.1 GENERAL: 17.1.1 and 17.1.2**	X							
(02)		Define the following acronyms: LRNS, MASPS, NAT HLA, OCA, OTS, PRM, RVSM, SLOP, and WATRS. **Source: NAT 007, Glossary of Terms**	X							
(03)		State the NAT HLA operations. **Source: NAT 007, 1.1.2; 1.1.3; 1.1.5; 1.1.6; 1.1.7; 1.2.1; 1.2.2; 1.3.1; 1.3.2; 1.3.6; 1.3.7; 1.3.8**	X							
(04)		Describe the routes for aircraft with only one long-range navigation system (LRNS). **Source: NAT 007, 1.4.1**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe the routes for aircraft with short-range navigation equipment only. **Source: NAT 007, 1.4.2; 1.4.3**	X							
(06)		Explain why the horizontal (i.e. latitudinal and longitudinal) and vertical navigation performance of operators within NAT HLA is monitored on a continual basis. **Source: NAT 007, 1.9.1**	X							
(07)		Describe the organised track system (OTS). **Source: NAT 007, 2.1 GENERAL; 2.2 Construction of the organised track system (OTS)**	X							
(08)		State the OTS changeover periods. **Source: NAT 007, 2.4 OTS Changeover periods**	X							
(09)		Describe the NAT track message. **Source: NAT 007, 2.3 The NAT track message**	X							
(10)		Illustrate routes between northern Europe and the Spain/Canaries/Lisbon flight information region (FIR) (T9, T13 and T16) within NAT HLA. **Source: NAT 007, 3.2 Other routes within the NAT HLA**	X							
(11)		Describe the function of the North American Routes (NARs) and Shannon Oceanic Transition Area (SOTA) and Northern Oceanic Transition Area (NOTA). **Source: NAT 007, 3.3 Route structures adjacent to the NAT HLA**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(12)		State that all flights should plan to operate on great-circle tracks joining successive significant waypoints. **Source: NAT 007, 4.1.3**	X							
(13)		State that during the hours of validity of the OTS, operators are encouraged to plan flights: — 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, — either laterally or vertically. Source: NAT 007, 4.1.4	X							
(14)		State which flight levels are available on OTS tracks during OTS periods. **Source: NAT 007, 4.1.10; 4.1.11 and 4.1.12 (dates not required)**	X							
(15)		State which flight levels are to be planned on random tracks or outside OTS periods. **Source: NAT 007, 4.1.13**	X							
(16)		Selection of cruising altitude. Specify the appropriate cruising levels for normal long-range IFR flights and for those operating on the North Atlantic OTS. **Source: NAT 007, Chapter 4 Flight Planning - Flight Levels; SERA**	X							
(17)		Oceanic ATC clearances State that it is recommended that pilots should request their oceanic clearance at least 40 minutes prior to the oceanic entry point estimated time of arrival (ETA). **Source: NAT 007, 5.1.2**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(18)		State that pilots should notify the oceanic area control centre (OAC) of the maximum acceptable flight level possible at the boundary. **Source: NAT 007, 5.1.3**	X							
(19)		State that at some aerodromes which are situated close to oceanic boundaries, the oceanic clearance must be obtained before departure. **Source: NAT 007, 5.1.5**	X							
(20)		State that if an aircraft, which would normally be RVSM- or NAT HLA-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 NAT HLA approval of the flight, then the pilot must advise ATC at initial contact when requesting oceanic clearance. **Source: NAT 007, 5.1.6**	X							
(21)		State that 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, unless providing position reports via automatic dependent surveillance — contract (ADS-C), the pilot must pass a revised estimate on to ATC. **Source: NAT 007, 5.1.7**	X							
(22)		State that pilots should pay particular attention when the issued clearance differs from the flight plan as a significant proportion of navigation errors	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		investigated in the NAT Region involve aircraft which have followed their flight plan rather than the differing clearance. **Source: NAT 007, 5.1.8**								
(23)		State that if the entry point of the oceanic route for which the flight is cleared differs from that originally requested or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic reclearance. **Source: NAT 007, 5.1.9**	X							
(24)		State that there are three elements to an oceanic clearance: route, Mach number, and flight level, and that these elements serve to provide for the three basic elements of separation: lateral, longitudinal, and vertical. **Source: NAT 007, 5.1.1**	X							
(25)		Communications and position-reporting procedures State that pilots communicate with OACs via aeradio stations staffed by communicators who have no executive ATC authority. Source: NAT 007, 6.1.1	X							
(26)		State that messages are relayed from the ground station to the air traffic controllers of the relevant OAC for action. **Source: NAT 007, 6.1.1**	X							
(27)		State that frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during daytime. Generally, in NAT, frequencies of less than 7 MHz are	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		utilised at night and frequencies greater than 8 MHz are utilised during the day. When initiating contact with an aeradio station, the pilot should state the HF frequency in use. **Source: NAT 007, 6.1.4 and 6.1.7**								
(28)		State that since oceanic traffic typically communicates with ATC through aeradio facilities, a satellite communication (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. **Source: NAT 007, 6.1.17**	X							
(29)		State that 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. **Source: NAT 007, 6.2.2**	X							
(30)		State that any pilot, who provides position reports via data link and encounters significant meteorological phenomena (such as moderate/severe turbulence or icing, volcanic ash or thunderstorms), should report this information. **Source: NAT 007, 6.5.2**	X							
(31)		State that all turbine-engined aeroplanes having a maximum certified take-off mass exceeding 5 700 kg or authorised to carry more than 19 passengers are required to	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		carry and operate airborne collision avoidance system (ACAS) II in the NAT Region. **Source: NAT 007, 6.9.1**								
(32)		State that even with the growing use of data-link communications, a significant volume of NAT air–ground communications are conducted using voice on single sideband (SSB) HF frequencies. To support air–ground ATC communications in the North Atlantic Region, 24 HF frequencies have been allocated, in bands ranging from 2.8 to 18 MHz. **Source: NAT 007, 6.1.3**	X							
(33)		Application of the Mach number technique (NAT HLA) State that 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. **Source: NAT 007, 7.2.1**	X							
(34)		State that 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. **Source: NAT 007, 7.4.1**	X							
		North Atlantic High Level Airspace (NAT HLA) flight operation and navigation procedures								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(35)		**NAT HLA flight operation and navigation procedures** State that the pre-flight procedures for any NAT HLA flight must include a Universal Time Coordinated (UTC) time check. **Source: NAT 007, 8.2.2**	X							
(36)		Describe the function and use of the master document. **Source: NAT 007, 8.2.5 to 8.2.9**	X							
(37)		State the requirements for position plotting. **Source: NAT 007, 8.2.10 to 8.2.13**	X							
(38)		Describe the pre-flight procedures for: — the alignment of IRS; — the satellite navigation availability prediction programme for flights using global navigation satellite long-range navigation system (GNSS LRNS); — loading of initial waypoints; and — flight plan check. **Source: NAT 007, 8.3.2 to 8.3.5; 8.3.6 to 8.3.8; 8.3.13 to 8.3.17**	X							
(39)		Describe the strategic lateral offset procedure (SLOP) and state that along a route or track there will be three positions that an aircraft may fly: centre line, or 1 or 2 miles right. **Source: NAT 007, 8.5.1 to 8.5.5**	X							
(40)		State that RNAV 10 retains the RNP 10 designation, as specified in the Performance-based Navigation Manual (ICAO Doc 9613), 1.2.3.5. (ICAO Doc 7030, NAT Chapter 4). **Source: NAT 007, 1.3.4**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(41)		State that both aircraft and operators must be RNP 10- or RNP 4-approved by the State of the Operator or the State of Registry, as appropriate. **Source: NAT 007, 1.3.4**	X							
(42)		State that RNP 10 is the minimum navigation specification for the application of 93 km (50 NM) lateral separation. **Source: NAT 007, 1.3.4 and 4.1.18**	X							
(43)		**Reduced vertical separation minima (RVSM) flight in NAT HLA** State the altimeter cross-check to be performed before entering NAT HLA. **Source: NAT 007, 9.1.10**	X							
(44)		State the altimeter cross-check to be performed when entering and flying in NAT HLA. **Source: NAT 007, 9.1.12**	X							
(45)		State that pilots not using controller–pilot data-link communications (CPDLC)/ADS-C always report to ATC immediately on leaving the current cruising level and on reaching any new cruising level. **Source: NAT 007, 9.1.15**	X							
(46)		State that flight crew should report when a 300-ft deviation or more occurs. **Source: NAT 007, 11.3.4 and 11.3.6**	X							
(47)		Navigation planning procedures List the factors to be considered by the commander before commencing the flight. **Source: NAT 007, 8.3 Pre-flight procedures**	X							
		Navigation system degradation (NAT Doc 007, Chapter 12)								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(48)		For this part, consider aircraft equipped with only two operational LRNSs and 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; and — the remaining system fails after entering NAT HLA. **Source: NAT 007, 12.2**	X							
		Special procedures for in-flight contingencies (NAT Doc 007, Chapter 13)								
(49)		State the general procedures and also state that the general concept of these NAT in-flight contingency procedures is, whenever operationally feasible, to offset the assigned route by 15 NM and climb or descend to a level which differs from those normally used by 500 ft if below FL 410 or by 1 000 ft if above FL 410. **Source: NAT 007, 13.1 and 13.2**	X							
(50)		State all the factors which may affect the direction of turn including: — direction to an alternate aerodrome; — terrain clearance; — levels allocated on adjacent routes or tracks and any known SLOP offsets adopted by other nearby traffic. **Source: NAT 007, 13.3.2**	X							
(51)		State that if the deviation around severe weather is to be greater than 10 NM, the assigned flight level must be changed by ±	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		300 ft depending on the followed track and the direction of the deviation. **Source: NAT 007, 13.4**								
071 01 03 04		**Extended-range operations with two-engined aeroplanes (ETOPS)**								
(01)		State that ETOPS approval is part of an AOC. **Source:** **Point SPA.ETOPS.100 'ETOPS';** **Point SPA.ETOPS.105 'ETOPS operational approval'**	X							
(02)		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. **Source: Point SPA.ETOPS.110 'ETOPS en-route alternate aerodrome**	X							
(03)		State the requirements for take-off alternate. **Source: Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes**	X							
(04)		State the planning minima for ETOPS en-route alternate. **Source: Point SPA.ETOPS.115 'ETOPS en-route alternate aerodrome planning minima'**	X							
(05)		Navigation-planning procedures. Describe the operator's responsibilities concerning ETOPS routes. **Source:**	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point CAT.OP.MPA.135 'Routes and areas of operation — general'; **Point CAT.OP.MPA.145 'Establishment of minimum flight altitudes';** **Point CAT.OP.MPA.150 'Fuel policy'**								
(06)		Selection of a route. Describe the limitations on extended-range operations with two-engined aeroplanes with and without ETOPS approval.	X							
(07)		Selection of alternate aerodrome. State the maximum flight distance of a take-off alternate for: — two-engined aeroplanes; — ETOPS-approved aeroplanes; — three- or four-engined aeroplanes. **Source: Point CAT.OP.MPA.180 'Selection of aerodromes — aeroplanes'**	X							
(08)		State the maximum distance from an adequate aerodrome for two-engined aeroplanes without an ETOPS approval. **Source: Point CAT.OP.MPA.140 'Maximum distance from an adequate aerodrome for two-engined aeroplanes without an ETOPS approval'**	X							
(09)		State the requirement for alternate aerodrome accessibility check for ETOPS operations.	X							
071 02 00 00		**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS — GENERAL ASPECTS**								
071 02 01 00		**Operations manual (Points ORO.MLR.100, ORO.MLR.101 and related AMCs/GM)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
071 02 01 01		**Operating procedures**								
(01)		Explain the general rules for the operations manual. **Source: Point ORO.MLR.100 'Operations manual — general'; AMC1 ORO.MLR.100**	X	X	X	X	X			
(02)		Explain the structure and subject headings of the operations manual. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; GM1 ORO.MLR.100(k) 'Operations manual — general'**	X	X	X	X	X			
(03)		Explain the requirements for a journey log or equivalent. **Source: Point ORO.MLR.110 'Journey log'; AMC1 ORO.MLR.110**	X	X	X	X	X			
(04)		Describe the requirements regarding the operational flight plan. **Source: Point ORO.MLR.115 'Record-keeping'**	X	X	X	X	X			
(05)		Explain the requirements for document-storage periods. **Source: Point ORO.MLR.115 'Record-keeping'; AMC1 ORO.MLR.115; GM1 ORO.MLR.115(c);(d)**	X	X	X	X	X			
(06)		Explain that all non-type-related operational policies, instructions and procedures required for a safe operation are included in Part A of the operations manual. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport; AMC3**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		ORO.MLR.100 'Operations manual — general' (main topics in Part A, e.g. General/Basic, etc.)								
(07)		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 list (MEL) and configuration deviation list(s) (CDL); — security; — handling of accidents and occurrences. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; AMC3 ORO.MLR.100 'Operations manual — general'**	X	X	X	X	X			
(08)		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 traffic alert and collision avoidance system (TCAS)/airborne collision avoidance system (ACAS). **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; AMC3 ORO.MLR.100 'Operations manual — general'**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		State that rotor downwash is included into Part A. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; AMC3 ORO.MLR.100 'Operations manual — general'**			X	X				
071 02 01 02		**Aeroplane/helicopter operating matters — type-related**								
(01)		State that all type-related instructions and procedures required for a safe operation are included in Part B of the operations manual. They take account of any differences between types, variants or individual aircraft used by an operator. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'**	X	X	X	X	X			
(02)		State that the following items are included into Part B: — abnormal and emergency procedures; — configuration deviation list (CDL); — minimum equipment list (MEL); — emergency evacuation procedures. **Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; AMC3 ORO.MLR.100 'Operations manual — general'**	X	X						
(03)		State that the following items are included into Part B: — emergency procedures; — configuration deviation list (CDL); — minimum equipment list (MEL); — emergency evacuation procedures.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Point ORO.MLR.101 'Operations manual — structure for commercial air transport'; AMC3 ORO.MLR.100 'Operations manual — general'								
071 02 01 03		**Minimum equipment list (MEL) and master minimum equipment list (MMEL)**								
(01)		Describe the following terms: 'commencement of flight', 'inoperative', 'MEL', 'MMEL', 'rectification interval'. **Source: GM1 ORO.MLR.105(a) 'Minimum equipment list'; CS-MMEL; GM2 ORO.MLR.105(d)(3)**	X	X	X	X	X			
(02)		Explain the relation between MMEL and MEL. Source: Point ORO.MLR.100 'Operations manual — general'; Point ORO.MLR.105 'Minimum equipment list'; AMC1 ORO.MLR.105(j);(g) GM1 ORO.MLR.105(j)	X	X	X	X	X			
(03)		Define the 'extent of the MEL'. **Source: AMC2 ORO.MLR.105(d)(3) 'Minimum equipment list'**	X	X	X	X	X			
(04)		Explain the responsibilities of the operator and the competent authority with regard to MEL and MMEL. **Source: Point ORO.MLR.100 'Operations manual — general'; Point ORO.MLR.105 'Minimum equipment list';**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		AMC1 ORO.MLR.105(c); **GM1 ORO.MLR.105(d)(3)**								
(05)		Explain the responsibilities of the flight crew members with regard to MEL. **Source:** **Points CAT.IDE.A.105/CAT.IDE.H.105 'Minimum equipment for flight'**	X	X	X	X	X			
(06)		Explain the responsibilities of the commander with regard to MEL. **Source:** **Point CAT.OP.MPA.175 'Flight preparation';** **Point CAT.IDE.A.105/CAT.IDE.H.105 'Minimum equipment for flight'**	X	X	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**								
(01)		Define the following terms: 'anti-icing', 'de-icing', 'one-step de-icing/anti-icing', 'two-step de-icing/anti-icing', 'holdover time'. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Glossary**	X	X						
(02)		Describe 'the clean aircraft concept' as presented in the relevant chapter of ICAO Doc 9640. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 2**	X	X						
(03)		List the types of de-icing/anti-icing fluids available.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 4, 4.1								
(04)		Explain the procedure to be followed when an aeroplane has exceeded the holdover time. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 4, 4.9**	X	X						
(05)		Interpret the guidelines for fluid holdover times and list the factors which can reduce the fluid protection time. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 5: 5.1, 5.2 and Attachment (5 tables)**	X	X						
(06)		Explain how the pre-take-off check, which is the responsibility of the pilot-in-command, ensures that the critical surfaces of the aircraft 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. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 6, 6.4**	X	X						
(07)		Explain why an aircraft has to be treated symmetrically. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 11**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Explain why an operator shall establish procedures to be followed when ground de-icing and anti-icing and related inspections of the aircraft are necessary. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1: Introduction 1.1 to 1.6**	X	X	X	X	X			
(09)		Explain why a commander shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect the performance or controllability of the aircraft except as permitted in the flight manual. **Source: ICAO Doc 9640 'Manual of Aircraft Ground De-icing/Anti-icing Operations'; Point CAT.OP.MPA.250 'Ice and other contaminants — ground procedures'**	X	X	X	X	X			
(10)		Explain the requirements for operations in icing conditions. **Source: Point CAT.OP.MPA.250 'Ice and other contaminants — ground procedures'; Point CAT.OP.MPA.255 'Ice and other contaminants — flight procedures'; Point CAT.IDE.A.165 'Additional equipment for operations in icing conditions at night'; Point CAT.IDE.H.165 'Additional equipment for operations in icing conditions at night'**	X	X	X	X	X			
(11)		Explain why safety must come before commercial pressures in relation to de-icing and anti-icing of aircraft. (Consider	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		time and financial cost versus direct and indirect effects of an incident/accident). **Source: N/A**								
071 02 02 02		**Procedure to apply in case of performance deterioration, on ground/in flight**								
(01)		Explain that the effects of icing are wide-ranging, unpredictable and dependent upon individual aircraft design. The magnitude of these effects is dependent upon many variables, but the effects can be both significant and dangerous. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1**	X	X	X	X	X			
(02)		Explain 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. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1**	X	X	X	X	X			
(03)		Explain 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. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Explain 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. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1**	X	X	X	X	X			
(05)		Explain 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, frost and snow formed in flight. **Source: ICAO Doc 9640 'Manual of Aircraft Ground Deicing/Anti-icing Operations', Chapter 1**	X	X	X	X	X			
(06)		Explain that flight in known icing conditions is subject to limitations that are contained in Part B of the operations manual. **Source: AMC4 ORO.MLR.100 'Operations manual — general**	X	X	X	X	X			
(07)		Explain where procedures and performances regarding flight in expected or actual icing conditions can be found. **Source: AMC4 ORO.MLR.100 'Operations manual — general'**	X	X	X	X	X			
071 02 03 00		**Bird-strike risk**								
071 02 03 01		**Bird-strike risk and avoidance**								
(01)		Explain that the presence of birds that constitute a potential hazard to aircraft operations is part of the pre-flight information. **Source: ICAO Annex 15, 8.1 Pre-flight information**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain how information concerning the presence of birds observed by aircrews is made available to the aeronautical information service (AIS) for distribution as the circumstances dictate. **Source: ICAO Annex 15, Chapter 8**	X	X	X	X	X			
(03)		Explain that the Aeronautical Information Publication (AIP) Section En-route (ENR) 5.6 contains information regarding bird migrations. **Source: ICAO Annex 15, Appendix 1**	X	X	X	X	X			
(04)		Explain significant data regarding bird strikes contained in ICAO Doc 9137 'Airport Services Manual'. **Source: ICAO Doc 9137 'Airport Services Manual', Chapter 1**	X	X	X	X	X			
(05)		Explain why birds constitute a hazard to aircraft (damage to probes, sensors, engines, windscreens, airframes, degradation in vision, etc.). **Source: N/A, though history in ICAO Doc 9137, Chapter 1. For more information, refer to the EGAST safety promotion leaflet 'Bird strike, a European risk with local specificities', available at: www.easa.europa.eu/system/files/dfu/EGAST_GA6-bird-strikesfinal.pdf**	X	X	X	X	X			
(06)		Define the commander's responsibilities regarding the reporting of bird hazards and bird strikes. **Source: Point CAT.GEN.MPA.105 'Responsibilities of the commander'**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		State that birds tend to flock to areas where food is plentiful. Such areas include: rubbish (garbage) facilities; open sewage treatment works; recently ploughed land; as well as their natural habitats. **Source: N/A**	X	X	X	X	X			
071 02 04 00		**Noise abatement**								
071 02 04 01		**Noise-abatement procedures**								
(01)		Define the operator's responsibilities regarding the establishment of noise-abatement procedures. **Source:** **Point CAT.OP.MPA.130 'Noise abatement procedures — aeroplanes'** **Point CAT.OP.MPA.131 'Noise abatement procedures — helicopters'**	X	X	X	X	X			
(02)		State the main purpose of noise-abatement departure procedure (NADP) 1 and NADP 2. **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 7, Appendix to Chapter 3, 1.1**	X	X	X	X	X			
(03)		State that the PIC/commander has the authority to decide not to execute an NADP if conditions preclude the safe execution of the procedure. **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 7, Chapter 3, 3.2.1 General**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
071 02 04 02		**Influence of the flight procedure (departure, cruise, approach)**								
(01)		List the main parameters for NADP 1 and NADP 2 (i.e. speeds, heights and configuration). **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 7, Chapter 3, 3.3 and Appendix to Chapter 3**	X	X						
(02)		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 noise-abatement purposes. **Source: ICAO Annex 14, Volume 1, 5.3.7.1/Volume 2, 5.3.4.1**	X	X	X	X	X			
(03)		State that detailed information about noise-abatement procedures is to be found in Part 'Aerodromes' (AD), Sections 2 and 3 of the AIP. **Source: ICAO Annex 15, Appendix 1**	X	X	X	X	X			
071 02 04 03		**Influence by the pilot (power setting, low drag)**								
(01)		List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 3, Chapter 1, 1.2.3 Reduced power take-off**	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		List the adverse operating conditions under which noise-abatement procedures during approach should not be required. **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 7, Chapter 2, 2.1 Noise preferential runways**	X	X						
(03)		State the rule regarding the use of reverse thrust on landing. **Source: ICAO Doc 8168 'Procedures for Air Navigation Services — Aircraft Operations' (PANS-OPS), Volume 1, Part I, Section 7, Chapter 3, 3.5 Aeroplane operating procedures — landing**	X	X						
071 02 04 04		**Influence by the pilot (power setting, track of helicopter)**								
(01)		List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required.			X	X	X			
071 02 05 00		**Fire and smoke**								
071 02 05 01		**Carburettor fire**								
(01)		Explain that the actions to be taken in the event of a carburettor fire may be type-specific and should be known by the pilot.	X	X	X	X	X			
071 02 05 02		**Engine fire**								
(01)		Explain that the actions to be taken in the event of an engine fire may be type-specific and should be known by the pilot.	X	X	X	X	X			
071 02 05 03		**Fire in the cabin, in the flight crew compartment and in the cargo compartment**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Identify the different types of extinguishants used in handheld fire extinguishers and the type of fire for which each one may be used.	X	X	X	X	X			
(02)		Describe the precautions to be considered when applying fire extinguishants.	X	X	X	X	X			
(03)		Identify the appropriate handheld fire extinguishers to be used in the flight crew compartment, the passenger cabin and lavatories, and in the cargo compartments.	X	X	X	X	X			
071 02 05 04		**Smoke in the flight crew compartment and in the cabin**								
(01)		Explain which actions should be taken in the event of smoke in the flight crew compartment or in the cabin, why these actions may be type-specific, and why they should be known by the pilot.	X	X	X	X	X			
071 02 05 05		**Actions in case of overheated brakes**								
(01)		Describe the problems and safety precautions in the event that brakes overheat after a heavy-weight landing or a rejected takeoff.	X	X						
(02)		Explain the difference in the way steel and carbon brakes react to energy absorption and the operational consequences.	X	X						
071 02 06 00		**Decompression of pressurised cabin**								
071 02 06 01		**Slow decompression**								
(01)		Explain what can cause, and how to detect, a slow decompression or an automatic pressurisation system failure.	X	X						
(02)		Describe the actions required following a slow decompression.	X	X						
071 02 06 02		**Rapid and explosive decompression**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain what can cause, and how to detect, a rapid or an explosive decompression.	X	X						
071 02 06 03		**Dangers and action to be taken**								
(01)		Describe the actions required following a rapid or explosive decompression.	X	X						
(02)		Describe the effects on aircraft occupants of a slow decompression and of 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**								
(01)		Explain how to identify low-level wind shear. **Source: ICAO Circular 186 'Wind Shear'**	X	X	X	X	X			
071 02 07 02		**Actions to avoid and actions to take when encountering wind shear**								
(01)		Describe the effects of wind shear and the actions required when wind shear is encountered at take-off and approach. **Source: ICAO Circular 186 'Wind Shear'**	X	X	X	X	X			
(02)		Describe the precautions to be taken when wind shear is suspected at take-off and approach. **Source: ICAO Circular 186 'Wind Shear'**	X	X	X	X	X			
(03)		Describe the effects of wind shear and the actions required following entry into a strong downdraft wind shear. **Source: ICAO Circular 186 'Wind Shear'**	X	X	X	X	X			
(04)		Describe a microburst and its effects. **Source: ICAO Circular 186 'Wind Shear'**	X	X	X	X	X			
071 02 08 00		**Wake turbulence**								
071 02 08 01		**Cause**								
(01)		Describe the term 'wake turbulence'.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part II								
(02)		Describe tip vortex circulation. **Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part II**	X	X	X	X	X			
(03)		State when vortex generation begins and ends. **Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part II**	X	X	X	X	X			
(04)		Describe vortex circulation on the ground with and without crosswind. **Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part I**	X	X	X	X	X			
071 02 08 02		**List of relevant parameters**								
(01)		List the three main factors which, when combined, give the strongest vortices (heavy, clean, slow). **Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part II**	X	X	X	X	X			
(02)		Describe the wind conditions which are worst for wake turbulence near the ground. **Source: ICAO Doc 9426 'Air Traffic Services Planning Manual', Part II**	X	X	X	X	X			
071 02 08 03		**Actions to be taken when crossing traffic, during take-off and landing**								
(01)		Describe the actions to be taken to avoid wake turbulence, specifically separations. **Source: ICAO Doc 4444 'Procedures for Air Navigation Services — Air Traffic Management' (PANS-ATM), 5.8 Time-based wake turbulence longitudinal separation minima**	X	X	X	X	X			
071 02 09 00		**Security (unlawful events)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
071 02 09 01		**ICAO Annex 17 and Regulation (EC) No 300/2008**								
(01)		Define the following terms: 'aircraft security check', 'screening', 'security', 'security-restricted area', 'unidentified baggage'. **Source: ICAO Annex 17, Chapter 1 Definitions**	X	X	X	X	X			
(02)		State the objectives of security. **Source: ICAO Annex 17, 2.1 Objectives**	X	X	X	X	X			
071 02 09 02		**Use of secondary surveillance radar (SSR)**								
(01)		Describe the commander's responsibilities concerning notifying the appropriate ATS unit. **Source: ICAO Annex 17, Attachment to Annex 17**	X	X	X	X	X			
(02)		Describe the commander's responsibilities concerning operation of SSR. **Source: ICAO Annex 17, Attachment to Annex 17**	X	X	X	X	X			
(03)		Describe the commander's responsibilities concerning departing from assigned track or cruising level. **Source: ICAO Annex 17, Attachment to Annex 17**	X	X	X	X	X			
(04)		Describe the commander's responsibilities concerning the action required or being requested by an ATS unit to confirm SSR code and ATS interpretation response. **Source: ICAO Annex 17, Attachment to Annex 17**	X	X	X	X	X			
071 02 09 03		**Security (Regulation (EC) No 300/2008 and ICAO Annex 17)**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the relationship between Regulation (EC) No 300/2008 and ICAO Annex 17. **Source: Regulation (EC) No 300/2008, Articles 1 and 2**	X	X	X	X	X			
(02)		Explain the requirements regarding training programmes. **Source: Regulation (EC) No 300/2008, Annex: 10 'In-flight security measures' and 11 'Staff recruitment and training'; ICAO Annex 17, 13.4 Training programmes**	X	X	X	X	X			
(03)		State the requirements regarding reporting acts of unlawful interference. **Source: ICAO Annex 17, 13.5 Reporting acts of unlawful interference**	X	X	X	X	X			
(04)		State the requirements regarding aircraft search procedures. **Source: ICAO Annex 17: 4.3 Measures relating to aircraft; 5.1 Prevention; 13.3 Aeroplane search procedure checklist**	X	X	X	X	X			
071 02 10 00		**Emergency and precautionary landing, and ditching**								
071 02 10 01		**Descriptions**								
(01)		Describe the meaning of: 'ditching', 'precautionary landing', and 'emergency landing'.	X	X	X	X	X			
(02)		Describe a ditching procedure.	X	X	X	X	X			
(03)		Describe a precautionary landing procedure.	X	X	X	X	X			
(04)		Describe an emergency landing procedure.	X	X	X	X	X			
(05)		Explain the factors to be considered when deciding to conduct a	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		precautionary/emergency landing or ditching.								
071 02 10 02		**Cause**								
(01)		List some circumstances that may require a ditching, a precautionary landing or an emergency landing.	X	X	X	X	X			
071 02 10 03		**Passenger information**								
(01)		Describe the briefing to be given to passengers before conducting a precautionary/emergency landing or ditching (including evacuation). **Source: AMC1 CAT.OP.MPA.170 'Passenger briefing'**	X	X	X	X	X			
071 02 10 04		**Action after a precautionary/emergency landing or ditching**								
(01)		Explain why an aircraft may need to jettison fuel so as to reduce its landing mass in order to make a safe landing. **Source: ICAO Doc 4444 'Procedures for Air Navigation Services — Air Traffic Management' (PANS-ATM), 15.5.3 Fuel dumping**	X	X						
(02)		Explain that when an aircraft that operates 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 flight level to be used, which should be not less than 1 800 m (6 000 ft); and — the duration of fuel jettisoning.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: ICAO Doc 4444 'Procedures for Air Navigation Services — Air Traffic Management' (PANS-ATM), 15.5.3 Fuel dumping								
(03)		Explain how flaps and slats may adversely affect fuel jettisoning. **Source: CS 25.1001 Fuel jettisoning system**	X	X						
071 02 11 02		**Requirements**								
(01)		Explain why a fuel-jettisoning system must be capable of jettisoning enough fuel within 15 minutes. **Source: CS 25.1001 Fuel jettisoning system**	X	X						
071 02 12 00		**Transport of dangerous goods by air**								
071 02 12 01		**ICAO Annex 18 (4th Edition, July 2011)**								
(01)		Define the following terms: 'dangerous goods', 'dangerous goods accident', 'dangerous goods incident', 'exemption', 'incompatible', 'packaging', 'UN number'. **Source: ICAO Annex 18, Chapter 1 Definitions**	X	X	X	X	X			
(02)		Explain that detailed provisions for the transport of dangerous goods by air are contained in the Technical Instructions for the Safe Transport of Dangerous Goods by Air. **Source: ICAO Doc 9284 'Technical Instructions for The Safe Transport of Dangerous Goods by Air'; ICAO Annex 18, Chapter 2, 2.2.1**	X	X	X	X	X			
(03)		State that in the event of an in-flight emergency, the pilot-in-command must	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		inform the ATC of the transport of dangerous goods by air. **Source: ICAO Annex 18, Chapter 9, 9.5**								
071 02 12 02		**Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Doc 9284)**								
(01)		Explain the principle of dangerous goods compatibility and segregation. **Source: ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air'**	X	X	X	X	X			
(02)		Explain the special requirements for the loading of radioactive materials. **Source: ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air'**	X	X	X	X	X			
(03)		Explain the use of the dangerous goods list. **Source: ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air'**	X	X	X	X	X			
(04)		Identify the labels. **Source: ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air'**	X	X	X	X	X			
071 02 12 03		**Regulation (EU) No 965/2012 — Annex IV (Part-CAT) and Annex V (Part-SPA)**	X	X	X	X	X			
(01)		Explain the terminology relevant to dangerous goods. **Source:** **Point SPA.DG.100 'Transport of dangerous goods';** **Point SPA.DG.105 'Approval to transport dangerous goods';**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point SPA.DG.110 'Dangerous goods information and documentation'								
(02)		Explain the scope of that Regulation. **Source: Point CAT.GEN.MPA.200 'Transport of dangerous goods'**	X	X	X	X	X			
(03)		Explain why the transport of dangerous goods by air is subject to operator approval. **Source:** **Point SPA.DG.100 'Transport of dangerous goods';** **AMC1 ARO.OPS.200 'Specific approval procedure'**								
(04)		Explain the limitations on the transport of dangerous goods by air. **Source:** **Point SPA.DG.100 'Transport of dangerous goods';** **Point SPA.DG.105 'Approval to transport dangerous goods';** **Point SPA.DG.110 'Dangerous goods information and documentation'**	X	X	X	X	X			
(05)		Explain the requirements for the acceptance of dangerous goods. **Source:** **Point SPA.DG.110 'Dangerous goods information and documentation';** **AMC1 SPA.DG.110(b) 'Dangerous goods information and documentation'**	X	X	X	X	X			
(06)		Explain the requirements regarding inspection for damage, leakage or contamination. **Source:**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Point SPA.DG.105 'Approval to transport dangerous goods'; **AMC1 SPA.DG.110(b) 'Dangerous goods information and documentation': (a)(1)**								
(07)		Explain the requirement for the provision of information to flight crew. **Source:** **Point SPA.DG.110 'Dangerous goods information and documentation';** **AMC1 SPA.DG.110(a);(b) 'Dangerous goods information and documentation'**	X	X	X	X	X			
(08)		Explain the requirements for dangerous goods incident and accident reports. **Source: Point CAT.GEN.MPA.200 'Transport of dangerous goods'**	X	X	X	X	X			
(09)		State that some articles and substances, which would otherwise be classed as dangerous goods, can be exempted if they are part of the aircraft equipment, or required for use during aeromedical flights. **Source: Point CAT.GEN.MPA.200 'Transport of dangerous goods'; ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air', 2.2 Exceptions for dangerous goods of the operator**	X	X	X	X	X			
(10)		Explain why some articles and substances may be forbidden for transport by air. **Source:** **Point CAT.GEN.MPA.200 'Transport of dangerous goods'; ICAO Doc 9284 'Technical Instructions for The Safe**	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Transport of Dangerous Goods by Air', 2.1 Dangerous goods forbidden for transport by air under any circumstance								
(11)		Explain why packing must comply with the specifications of the Technical Instructions. **Source: ICAO Doc 9284 'Technical Instructions for The Safe Transport of Dangerous Goods by Air', Introductory chapter, 2.4 (for packing purposes, etc.)**	X	X	X	X	X			
(12)		Explain the need for an inspection prior to loading dangerous goods on an aircraft. **Source:** **Point CAT.GEN.MPA.200 'Transport of dangerous goods';** **AMC1 SPA.DG.110(b) 'Dangerous goods information and documentation'**	X	X	X	X	X			
(13)		Explain why some dangerous goods are designated for carriage only on cargo aircraft. **Source: ICAO Annex 18, 8.9 Loading on cargo aircraft; ICAO Doc 9284 'Technical Instructions For The Safe Transport of Dangerous Goods by Air', GENERAL PRINCIPLES**	X	X	X	X	X			
(14)		Explain how misdeclared or undeclared dangerous goods found in baggage are to be reported. **Source: Point CAT.GEN.MPA.200 and related AMCs/GM**	X	X	X	X	X			
071 02 13 00		**Contaminated runways**								
071 02 13 01		**Intentionally left blank**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
071 02 13 02		**Estimated surface friction, friction coefficient**								
(01)		Identify the difference between friction coefficient and estimated surface friction. **Source: ICAO Annex 15, Appendix 2**	X	X						
071 02 13 03		**Hydroplaning principles and effects**								
(01)		Define the different types of hydroplaning. **Source: NASA TM-85652 — Tire friction performance**	X	X						
(02)		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). **Source: NASA TM-85652 — Tire friction performance**	X	X						
(03)		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. **Source: NASA TM-85652 — Tire friction performance**	X	X						
071 02 13 04		**Intentionally left blank**								
071 02 13 05		**Snowtam and contamination on the aerodrome**								
(01)		Interpret from a snowtam the contamination and braking action on a runway, taxiways and apron. **Source: ICAO Annex 15, Appendix 2**	X	X						
(02)		Explain which hazards can be identified from the SNOWTAM/METAR and how to mitigate them.	X	X	X	X	X			
071 02 14 00		**Rotor downwash**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
071 02 14 01		**Describe downwash**								
(01)		Describe the downwash.			X	X	X			
071 02 14 02		**Effects**								
(01)		Explain its effects: 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**								
(01)		Give the definition of 'white-out'.			X	X	X			
(02)		Describe loss of spatial orientation.			X	X	X			
(03)		Describe take-off and landing techniques.			X	X	X			
071 02 15 02		**Strong winds**								
(01)		Describe blade sailing.			X	X	X			
(02)		Describe wind operating envelopes.			X	X	X			
(03)		Describe vertical speed problems.			X	X	X			
071 02 15 03		**Mountain environment**								
(01)		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**								
(01)		Describe recovery techniques in the event of engine failure during hover, climb, cruise, approach.			X	X	X			
071 03 01 02		**Fire in the cabin, in the flight crew compartment and in the engine(s)**								
(01)		Describe the basic actions when encountering fire in the cabin, flight deck or engine(s).			X	X	X			
071 03 01 03		**Tail-rotor directional control failure**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the basic actions following loss of tail rotor.			X	X	X			
(02)		Describe the basic actions following loss of directional control.			X	X	X			
071 03 01 04		**Ground resonance**								
(01)		Describe recovery actions.			X	X	X			
071 03 01 05		**Blade stall**								
(01)		Describe cause of and recovery actions when encountering retreating blade stall.			X	X	X			
071 03 01 06		**Setting with power (vortex ring)**								
(01)		Describe potential conditions for this event and recovery actions.			X	X	X			
071 03 01 07		**Overpitch**								
(01)		Describe recovery actions.			X	X	X			
071 03 01 08		**Overspeed: rotor/engine**								
(01)		Describe overspeed control.			X	X	X			
071 03 01 09		**Dynamic rollover**								
(01)		Describe potential conditions for this event and recovery action.			X	X	X			
071 03 01 10		**Mast bumping**								
(01)		Describe potential conditions of the ‘conducive to’ and ‘avoidance of’ effect.			X	X	X			
071 04 01 00		**SPECIALISED OPERATIONS (Regulation (EU) No 965/2012 on air operations, as amended)**								
071 04 01 01		**Additional requirements for commercial specialised operations and CAT operations (BAR 6 Part-ORO, Subpart FC, Section 3)**								
(01)		Explain the requirements related to flight crew recurrent training and checking and operator proficiency check.	X	X	X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Source: Point ORO.FC.330 'Recurrent training and checking — operator proficiency check'								
071 04 01 02		**General requirements (Annex VIII (Part-SPO), Subpart A)**								
(01)		Explain the task specialist's responsibilities. **Source: Point SPO.GEN.106 'Task specialists responsibilities'**	X	X	X	X	X			
071 04 01 03		**Helicopter external sling load operations (HESLO) (Annex VIII (Part-SPO), Subpart E)**			X	X	X			
(01)		Explain the standard operating procedures and equipment requirements. **Source: Point SPO.SPEC.HESLO.100 'Standard operating procedures' and related AMCs/GM; Point SPO.SPEC.HESLO.105 'Specific HESLO equipment' and related AMCs/GM**			X	X	X			
071 04 01 04		**Human external cargo operations (HEC) (Annex VIII (Part-SPO), Subpart E)**			X	X	X			
(01)		Explain the standard operating procedures and equipment requirements. **Source:** **Point SPO.SPEC.HEC.100 'Standard operating procedures' and related AMCs/GM;** **Point SPO.SPEC.HEC.105 'Specific HEC equipment' and related AMCs/GM**			X	X	X			

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SUBJECT 081 – PRINCIPLES OF FLIGHT – AEROPLANES

(1) The following standard symbols and their corresponding meanings are used for certain mathematical operations:

* 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 true airspeed (TAS). (6) In addition, when discussing propeller rotational direction, it will always be specified as seen from behind the propeller plane.

(7) Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe 'mass'. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
080 00 00 00		**PRINCIPLES OF FLIGHT**								
081 00 00 00		**PRINCIPLES OF FLIGHT — AEROPLANES**								
081 01 00 00		**SUBSONIC AERODYNAMICS**								
081 01 01 00		**Basics, laws and definitions**								
081 01 01 01		***Laws and definitions***								
(01)		List the international system of units of measurement (SI) for mass, acceleration, weight, velocity, energy, density,	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		temperature, pressure, force, wing loading, and power.								
(02)	X	Define ‘mass’, ‘force’, ‘acceleration’, and ‘weight’.	X	X						
(03)		State and interpret Newton’s three laws of motion.	X	X						
(04)	X	Explain air density.	X	X						
(05)	X	List the atmospheric properties that effect air density.	X	X						
(06)		Explain how temperature and pressure changes affect air density.	X	X						
(07)	X	Define ‘static pressure’.	X	X						
(08)	X	Define ‘dynamic pressure’	X	X						
(09)	X	State the formula for ‘dynamic pressure’.	X	X						
(10)		Describe dynamic pressure in terms of an indication of the energy in the system, and how it is related to indicated airspeed (IAS) and air density for a given altitude and speed.	X	X						
(11)		State Bernoulli’s equation for incompressible flow.	X	X						
(12)		Define ‘total pressure’ and explain that the total pressure differs in different systems.	X	X						
(13)		Apply Bernoulli’s equation to flow through a venturi stream tube for incompressible flow.	X	X						
(14)		Describe how IAS is acquired from the pitot static system.	X	X						
(15)		Describe the relationship between density, temperature, and pressure for air.	X	X						
(16)		Explain the equation of continuity and its application to the flow through a stream tube.	X	X						
(17)	X	Define ‘IAS’, ‘CAS’, ‘EAS’, and ‘TAS’.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 01 01 02		***Basics of airflow***								
(01)	X	Describe steady and unsteady airflow.	X	X						
(02)	X	Explain the concept of a streamline and a stream tube.	X	X						
(03)	X	Describe and explain airflow through a stream tube.	X	X						
(04)	X	Explain the difference between two- and three-dimensional airflow.	X	X						
081 01 01 03		***Aerodynamic forces on aerofoils***								
(01)		Describe the originating point and direction of the resultant force caused by the pressure distribution around an aerofoil	X	X						
(02)	X	Resolve the resultant force into the components ‘lift’ and ‘drag’.	X	X						
(03)		Describe the direction of lift and drag.	X	X						
(04)	X	Define the ‘aerodynamic moment’.	X	X						
(05)	X	List the factors that affect the aerodynamic moment.	X	X						
(06)		Describe the aerodynamic moment for a symmetrical aerofoil.	X	X						
(07)		Describe the aerodynamic moment for a positively and negatively cambered aerofoil.	X	X						
(08)	X	Define ‘angle of attack’ (α).	X	X						
081 01 01 04		***Shape of an aerofoil section***								
(01)	X	Describe the following parameter of an aerofoil section: leading edge.	X	X						
(02)	X	Describe the following parameter of an aerofoil section: trailing edge.	X	X						
(03)		Describe the following parameter of an aerofoil section: chord line.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Describe the following parameter of an aerofoil section: thickness-to-chord ratio or relative thickness.	X	X						
(05)		Describe the following parameter of an aerofoil section: location of maximum thickness.	X	X						
(06)		Describe the following parameter of an aerofoil section: camber line.	X	X						
(07)		Describe the following parameter of an aerofoil section: camber.	X	X						
(08)	X	Describe the following parameter of an aerofoil section: nose radius.	X	X						
(09)	X	Describe a symmetrical and an asymmetrical aerofoil section.	X	X						
081 01 01 05		***Wing shape***								
(01)	X	Describe the following parameter of a wing: span.	X	X						
(02)	X	Describe the following parameter of a wing: tip and root chord.	X	X						
(03)		Describe the following parameter of a wing: taper ratio.	X	X						
(04)	X	Describe the following parameter of a wing: wing area.	X	X						
(05)		Describe the following parameter of a wing: wing planform.	X	X						
(06)	X	Describe the following parameter of a wing: mean geometric chord.	X	X						
(07)		Describe the following parameter of a wing: mean aerodynamic chord (MAC).	X	X						
(08)		Describe the following parameter of a wing: aspect ratio.	X	X						
(09)	X	Describe the following parameter of a wing: dihedral angle.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(10)	X	Describe the following parameter of a wing: sweep angle.	X	X						
(11)	X	Describe the following parameter of a wing: wing twist, geometric and aerodynamic.	X	X						
(12)		Describe the following parameter of a wing: angle of incidence. Remark: In certain textbooks, angle of incidence is used as angle of attack (α). 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.	X	X						
081 01 02 00		**Two-dimensional airflow around an aerofoil**								
081 01 02 01		***Streamline pattern***								
(01)	X	Describe the streamline pattern around an aerofoil.	X	X						
(02)		Describe converging and diverging streamlines, and their effect on static pressure and velocity.	X	X						
(03)	X	Describe upwash and downwash.	X	X						
081 01 02 02		***Stagnation point***								
(01)		Describe the stagnation point.	X	X						
(02)		Describe the movement of the stagnation point as the α changes.	X	X						
081 01 02 03		***Pressure distribution***								
(01)		Describe pressure distribution and local speeds around an aerofoil including effects of camber and α.	X	X						
(02)		***Intentionally left blank***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 01 02 04		***Centre of pressure (CP) and aerodynamic centre (AC)***								
(01)		Explain CP and AC.	X	X						
081 01 02 05		***Intentionally left blank***								
081 01 02 06		***Drag and wake***								
(01)	X	List two physical phenomena that cause drag.	X	X						
(02)		Describe skin friction drag.	X	X						
(03)		Describe form (pressure) drag.	X	X						
(04)	X	Explain why drag and wake cause loss of energy (momentum).	X	X						
081 01 02 07		***Influence of angle of attack (α)***								
(01)		Explain the influence of α on lift.	X	X						
081 01 02 08		***Intentionally left blank***								
081 01 02 09		***The lift coefficient (C_L) – angle of attack (α) graph***								
(01)		Describe the C_L–α graph.	X	X						
(02)		Explain the significant points: — point where the curve crosses the horizontal axis (zero lift); — point where the curve crosses the vertical axis (α = 0); — point where the curve reaches its maximum (C_{LMAX}).	X	X						
081 01 03 00		**Coefficients**								
081 01 03 01		***General use of coefficients***								
(01)	X	Explain why coefficients are used in general.	X	X						
081 01 03 02		***The lift coefficient (C_L)***								
(01)		Explain the lift formula, the factors that affect lift, and perform simple calculations.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the effect of camber on the C_L–α graph (symmetrical and positively/negatively cambered aerofoils).	X	X						
(03)		Describe the typical difference in the C_L–α graph for fast and slow aerofoil design.	X	X						
(04)	X	Define 'C_{LMAX}' (maximum lift coefficient) and 'α_{CRIT}' (stalling α) on the graph.	X	X						
(05)		Describe C_L and explain the variables that affect it in low subsonic flight.	X	X						
081 01 03 03		***Drag***								
(01)		Describe the two-dimensional drag formula.	X	X						
(02)		Discuss the effect of the shape of a body, cross-sectional area, and surface roughness on the drag coefficient.	X	X						
081 01 04 00		**Three-dimensional airflow around an aeroplane**								
081 01 04 01		***Angle of attack (α)***								
(01)	X	Define 'angle of attack' (α). Remark: For theoretical knowledge examination purposes, the angle-of-attack definition requires a reference line. This reference line for 3D has been chosen to be the longitudinal axis and for 2D the chord line.	X	X						
(02)		Explain the difference between the α and the attitude of an aeroplane.	X	X						
081 01 04 02		***Streamline pattern***								
(01)		Describe the general streamline pattern around the wing, tail section, and fuselage.	X	X						
(02)		Explain and describe the causes of spanwise flow over top and bottom surfaces.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Describe wing tip vortices and their contribution to downwash behind the wing.	X	X						
(04)		Explain why wing tip vortices vary with α.	X	X						
(05)		Describe spanwise lift distribution including the effect of wing planform.	X	X						
(06)		Describe the causes, distribution and duration of the wake turbulence behind an aeroplane.	X	X						
(07)		Describe the influence of flap deflection on the wing tip vortex.	X	X						
(08)		Describe the parameters that influence wake turbulence.	X	X						
081 01 04 03		***Induced drag***								
(01)		Explain the factors that cause induced drag.	X	X						
(02)		Describe the approximate formula for the induced drag coefficient (including variables but excluding constants).	X	X						
(03)		Describe the relationship between induced drag and total drag in straight and level flight with variable speed.	X	X						
(04)		Describe the effect of mass on induced drag at a given IAS.	X	X						
(05)		Describe the means to reduce induced drag: — aspect ratio; — winglets; — tip tanks; — wing twist; — camber change.	X	X						
(06)		Describe the influence of lift distribution on induced drag.	X	X						
(07)		Describe the influence of downwash on the effective airflow.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Explain induced and effective local α.	X	X						
(09)		Explain the influence of the induced α on the direction of the lift vector.	X	X						
(10)		Explain the relationship between induced drag and: — speed; — aspect ratio; — wing planform; — bank angle in a horizontal coordinated turn.	X	X						
(11)		Explain the induced drag coefficient and its relationship with the lift coefficient and aspect ratio.	X	X						
(12)		Explain the influence of induced drag on: — the C_L–α graph, and show the effect on the graph when comparing high- and low-aspect ratio wings; — the C_L–C_D (aeroplane polar), and show the effect on the graph when comparing high- and low-aspect ratio wings; — the parabolic aeroplane polar in a graph and as a formula [$C_D = C_{PD} + kC_L^2$], where C_D = coefficient of drag and C_{PD} = coefficient of parasite drag.	X	X						
(13)		Describe the C_L–C_D graph (polar).	X	X						
(14)		Indicate minimum drag on the graph.	X	X						
(15)		Explain why the C_L–C_D ratio is important as a measure of performance.	X	X						
(16)		***Intentionally left blank***	X	X						
081 01 05 00		**Total drag**								
081 01 05 01		***Total drag in relation to parasite drag and induced drag***								
(01)	X	State that total drag consists of parasite drag and induced drag.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 01 05 02		***Parasite drag***								
(01)		Describe the types of drag that are included in parasite drag.	X	X						
(02)		Describe form (pressure) drag and the factors which affect its magnitude.	X	X						
(03)		Describe interference drag and the factors which affect its magnitude.	X	X						
(04)		Describe friction drag and the factors which affect its magnitude.	X	X						
081 01 05 03		***Parasite drag and speed***								
(01)		Describe the relationship between parasite drag and speed.	X	X						
081 01 05 04		***Induced drag and speed*** *(Refer to 081 01 04 03)*								
081 01 05 05		***Total drag***								
(01)		Explain the total drag–speed graph and the constituent drag components.	X	X						
(02)		Indicate the speed for minimum drag.	X	X						
081 01 05 06		***Intentionally left blank***								
081 01 05 07		***Variables affecting the total drag–speed graph***								
(01)		Describe the effect of aeroplane gross mass on the graph.	X	X						
(02)		Describe the effect of pressure altitude on: — drag–IAS graph; — drag–TAS graph.	X	X						
(03)		Describe speed stability from the graph.	X	X						
(04)		Describe non-stable, neutral, and stable IAS regions.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Explain what happens to the IAS and drag in the non-stable region if speed suddenly decreases and why this could occur.	X	X						
081 01 06 00		**Ground effect**								
081 01 06 01		***Influence of ground effect***								
(01)		Explain the influence of ground effect on wing tip vortices, downwash, airflow pattern, lift, and drag.	X	X						
(02)		Describe the influence of ground effect on induced α and the coefficient of induced drag (C_{Di}).	X	X						
(03)		Explain the effects of entering and leaving ground effect.	X	X						
081 01 06 02		***Effect on stalling angle of attack (α_{CRIT})***								
(01)		Describe the influence of ground effect on α_{CRIT}.	X	X						
081 01 06 03		***Effect on lift coefficient (C_L)***								
(01)		Describe the influence of ground effect on the effective α and C_L.	X	X						
081 01 06 04		***Effect on take-off and landing characteristics of an aeroplane***								
(01)		Describe the influence of ground effect on take-off and landing characteristics and performance of an aeroplane.	X	X						
(02)		Describe the difference in take-off and landing characteristics of high- and low-wing aeroplanes.	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***								
(01)		Explain the effect on C_L during speed increase/decrease in steady, straight, and	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		level flight, and perform simple calculations.								
081 01 07 02		***Represented by a graph***								
(01)		Explain, by using a graph, the effect on speed of C_L changes at a given weight.	X	X						
081 01 08 00		**Intentionally left blank**								
081 01 09 00		**C_{LMAX} augmentation**								
081 01 09 01		***Trailing-edge flaps and the reasons for their use in take-off and landing***								
(01)		From the given relevant diagrams, describe or identify the following types of trailing-edge flaps: — split flaps; — plain flaps; — slotted flaps; — Fowler flaps.	X	X						
(02)		Describe how the wing's effective camber increases the C_L and C_D, and the reasons why this can be beneficial.	X	X						
(03)		Describe their effect on: — the location of CP; — pitching moments (due to wing CP movement); — stall speed.	X	X						
(04)		Compare their influence on the C_L–α graph: — indicate the variation in C_L at any given α; — indicate their effect on C_{LMAX}; — indicate their effect on critical α; — indicate their effect on the α at a given C_L.	X	X						
(05)		Compare their influence on the C_L–C_D graph:	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— indicate how the $(C_L/C_D)_{MAX}$ differs from that of a clean wing.								
(06)		Explain the influence of trailing-edge flap deflection on the glide angle.	X	X						
(07)		Describe flap asymmetry: — explain the effect on aeroplane controllability.	X	X						
(08)		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.	X	X						
(09)		Explain the effects of flap-setting errors, such as mis-selection and premature/late extension or retraction of flaps, on: — take-off and landing distance and speeds; — climb and descent performance; — stall buffet margins.	X	X						
081 01 09 02		***Leading-edge devices and the reasons for their use in take-off and landing***								
(01)		From the given relevant diagrams, describe or identify the different types of leading-edge high-lift devices: — Krueger flaps; — variable camber flaps; — slats.	X	X						
(02)		Describe the function of the slot.	X	X						
(03)		Describe how the wing's effective camber increases with a leading-edge flap.	X	X						
(04)		Explain the effect of leading-edge flaps on the stall speed, also in comparison with trailing-edge flaps.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Compare their influence on the C_L–α graph, compared with trailing-edge flaps and a clean wing: — indicate the effect of leading-edge devices on C_{LMAX}; — explain how the C_L curve differs from that of a clean wing; — indicate the effect of leading-edge devices on α_{CRIT}.	X	X						
(06)		Compare their influence on the C_L–C_D graph.	X	X						
(07)		Describe slat asymmetry: — describe the effect on aeroplane controllability.	X	X						
(08)		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.	X	X						
081 01 09 03		***Vortex generators***								
(01)		Explain the purpose of vortex generators.	X	X						
(02)		Describe the basic operating principle of vortex generators.	X	X						
(03)		State their advantages and disadvantages.	X	X						
081 01 10 00		**Means to reduce the C_L–C_D ratio**								
081 01 10 01		***Spoilers and the reasons for their use in the different phases of flight***								
(01)		Describe the aerodynamic functioning of spoilers: — roll spoilers; — flight spoilers (speed brakes);	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— ground spoilers (lift dumpers).								
(02)		Describe the effect of spoilers on the C_L–α graph and stall speed.	X	X						
(03)		Describe the influence of spoilers on the C_L–C_D graph and lift-drag ratio.	X	X						
081 01 10 02		***Speed brakes and the reasons for their use in the different phases of flight***								
(01)		Describe speed brakes and the reasons for using them in the different phases of flight.	X	X						
(02)		State their influence on the C_L–C_D graph and lift–drag ratio.	X	X						
(03)		Explain how speed brakes increase parasite drag.	X	X						
(04)		Describe how speed brakes affect the minimum drag speed.	X	X						
(05)		Describe their effect on rate and angle of descent.	X	X						
081 01 11 00		**Intentionally left blank**								
081 01 12 00		**Aerodynamic degradation**								
081 01 12 01		***Ice and other contaminants***								
(01)		Describe the locations on an aeroplane where ice build-up will occur during flight.	X	X						
(02)		Explain the aerodynamic effects of ice and other contaminants on: — lift (maximum C_L); — drag; — stall speed; — α_{CRIT}; — stability and controllability.	X	X						
(03)		Explain the aerodynamic effects of icing during take-off.	X	X						
081 01 12 02		***Deformation and modification of airframe, ageing aeroplanes***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the effect of airframe deformation and modification of an ageing aeroplane on aeroplane performance.	X	X						
(02)		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***								
(01)	X	Define 'speed of sound'.	X							
(02)		Explain the variation of the speed of sound with altitude.	X							
(03)		Explain the influence of temperature on the speed of sound.	X							
081 02 01 02		***Mach number***								
(01)		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***								
(01)		Explain the absence of change of Mach number with varying temperature at constant flight level and calibrated airspeed.	X							
(02)		Explain the relationship between Mach number, TAS and IAS during climb and descent at constant Mach number or IAS, and explain variation of lift coefficient, α, pitch and flight-path angle.	X							
(03)		Explain: — risk of exceeding the maximum operation speed (V_{MO}) when descending at constant Mach number; — risk of exceeding the maximum operating Mach number (M_{MO}) when climbing at constant IAS;	X							

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			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— risk of a low-speed stall at high altitude when climbing at a too low Mach number.								
081 02 01 04		***Compressibility***								
(01)		State that compressibility means that density can change along a streamline, and that this occurs in the high subsonic (from Mach 0.4), transonic, and supersonic flow.	X							
(02)	X	State that compressibility negatively affects the pressure gradient, leading to an overall reduction of the C_L.	X							
(03)	X	State that Mach number is a measure of compressibility.	X							
(04)		Describe that compressibility increases low-speed stall speed and decreases α_{CRIT}.	X							
081 02 01 05		***Subdivision of aerodynamic flow***								
(01)	X	List the subdivision of aerodynamic flow: — subsonic flow below compressibility; — subsonic flow above compressibility; — transonic flow; — supersonic flow.	X							
(02)		Describe the characteristics of the flow regimes listed above.	X							
(03)		Explain why some transport aeroplanes cruise at Mach numbers above the critical Mach number (M_{CRIT}).	X							
081 02 02 00		**Shock waves**								
081 02 02 01		***Definition of shock wave***								
(01)	X	Define a ‘shock wave’.	X							
081 02 02 02		***Normal shock waves***								
(01)		Describe a normal shock wave with respect to changes in: — static temperature;	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— static and total pressure; — velocity; — local speed of sound; — density.								
(02)		Describe a normal shock wave with respect to orientation relative to the wing surface.	X							
(03)		Explain the influence of increasing Mach number on a normal shock wave, at positive lift, with respect to: — strength; — position relative to the wing; — second shock wave at the lower surface	X							
(04)		Explain the influence of α on shock-wave intensity and shockwave location at constant Mach number.	X							
081 02 03 00		**Effects of exceeding the critical Mach number (M_{CRIT})**								
081 02 03 01		***Critical Mach number (M_{CRIT})***								
(01)		Define 'MCRIT'.	X							
(02)		Explain how a change in α, aeroplane weight, manoeuvres, and centre-of-gravity (CG) position influences M_{CRIT}.	X							
081 02 03 02		***Effect on lift***								
(01)		Describe the behaviour of C_L versus Mach number at constant α.	X							
(02)		Explain the consequences of exceeding MCRIT with respect to C_L and C_{LMAX}.	X							
(03)		Explain the change in stall indicated airspeed (IAS) with altitude.	X							
(04)		Discuss the effect on α_{CRIT}.	X							
(05)		Explain the advantages of exceeding M_{CRIT} in aeroplanes with supercritical aerofoils with respect to:	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— speed versus drag ratio; — specific range; — optimum altitude.								
081 02 03 03		***Effect on drag***								
(01)		Describe wave drag.	X							
(02)		Describe the behaviour of CD versus Mach number at constant α.	X							
(03)		Explain the effect of Mach number on the C_L–C_D graph.	X							
(04)		Describe the effects and hazards of exceeding MDRAG DIVERGENCE, namely: — drag rise; — instability; — Mach tuck; — shock stall.	X							
(05)		State the relation between MCRIT and MDRAG DIVERGENCE.	X							
081 02 03 04		***Effect on pitching moment***								
(01)		Discuss the effect of Mach number on the CP location.	X							
(02)		Describe the overall change in pitching moment and explain the ‘tuck under’ or ‘Mach tuck’ effect.	X							
(03)	X	State the requirement for a Mach trim system to compensate for the effect of the CP movement and ‘tuck under’ effect.	X							
(04)	X	Discuss the aerodynamic functioning of the Mach trim system.	X							
(05)		Discuss the corrective measures if the Mach trim fails.	X							
081 02 03 05		***Effect on control effectiveness***								
(01)		Discuss the effects on the effectiveness of control surfaces.	X							

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 02 04 00		***Intentionally left blank***								
081 02 05 00		**Means to influence critical Mach number (M_{CRIT})**								
081 02 05 01		***Wing sweep***								
(01)		Explain the influence of the angle of sweep on: — M_{CRIT}; — effective thickness/chord change or velocity component perpendicular to the quarter chord line.	X							
(02)		Describe the influence of the angle of sweepback at subsonic speed on: — C_{LMAX}; — efficiency of and requirement for high-lift devices; — pitch-up stall behaviour.	X							
(03)		Discuss the effect of wing sweepback on drag.	X							
081 02 05 02		***Aerofoil shape***								
(01)		Explain the use of thin aerofoils with reduced camber.	X							
(02)		Explain the main purpose of supercritical aerofoils.	X							
(03)		*Intentionally left blank*								
(04)		Explain the advantages and disadvantages of supercritical aerofoils for wing design.	X							
081 02 05 03		***Vortex generators***								
(01)		Explain the use of vortex generators as a means to avoid or restrict flow separation caused by the presence of a normal shock wave.	X							
081 03 00 00		**Stall, Mach tuck, and upset prevention and recovery**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 03 01 00		**The stall**								
081 03 01 01		***Flow separation at increasing α***								
(01)	X	Define the 'boundary layer'.	X	X						
(02)	X	Describe the thickness of a typical laminar and turbulent boundary layer.	X	X						
(03)		Describe the properties, advantages and disadvantages of the laminar boundary layer.	X	X						
(04)		Describe the properties, advantages and disadvantages of the turbulent boundary layer.	X	X						
(05)		Define the 'transition point'.	X	X						
(06)		Explain why the laminar boundary layer separates easier than the turbulent boundary layer does.	X	X						
(07)		Describe why the airflow over the aft part of a wing slows down as the α increases.	X	X						
(08)		Define the 'separation point' and describe its location as a function of α.	X	X						
(09)	X	Define α_{CRIT}.	X	X						
(10)		Describe in straight and level flight the influence of increasing the α and the phenomenon that may occur regarding: — the forward stagnation point; — the pressure distribution; — the CP location (straight and swept-back wing); — C_L; — C_D and D (drag); — the pitching moment (straight and swept-back wing); — buffet onset; — deterrent buffet for a clean wing at high Mach number;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— lack of pitch authority; — uncommanded pitch down;								
(11)		Explain what causes the possible natural buffet on the aeroplane in a pre-stall condition.	X	X						
(12)		Describe the effectiveness of the flight controls in a pre-stall condition.	X	X						
(13)		Describe and explain the normal post-stall behaviour of a straight-wing aeroplane.	X	X						
(14)		Describe the effect and dangers of using the controls close to the stall.	X	X						
(15)		Describe the deterrent buffet.	X	X						
(16)		Explain the occurrence of the deterrent buffet and why this phenomenon is considered to be a stall limit.	X	X						
081 03 01 02		***The stall speed***								
(01)		Explain V_{S0}, V_{S1}, V_{SR}, and V_{S1G}.	X	X						
(02)		Solve V_{S1G} from the lift formula given varying C_L.	X	X						
(03)		Describe and explain the influence of the following parameters on stall speed: — CG; — thrust component; — slipstream; — wing loading; — mass; — wing contamination; — angle of sweep; — altitude (for compressibility effects, see 081 02 03 02).	X	X						
(04)	X	Define the 'load factor n'.	X	X						
(05)		Explain why the load factor increases in a turn.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre.	X	X						
(07)		Describe and explain the influence of the 'load factor n' on stall speed.	X	X						
(08)	X	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.*	X	X						
(09)		Calculate the change of stall speed as a function of the load factor.	X	X						
(10)		Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle.	X	X						
(11)		Calculate the change of stall speed as a function of the gross mass.	X	X						
081 03 01 03		***The initial stall in spanwise direction***								
(01)		Explain the initial stall sequence on the following planforms: — elliptical; — rectangular; — moderate and high taper; — sweepback or delta.	X	X						
(02)		Explain the purpose of aerodynamic and geometric twist (washout).	X	X						
(03)		*Intentionally left blank*	X	X						
(04)		Explain the influence of fences, vortilons, saw teeth, vortex generators, and strakes on engine nacelles.	X	X						
081 03 01 04		***Stall warning***								
(01)	X	Explain why stall warning is necessary.	X	X						
(02)	X	Explain when aerodynamic and artificial stall warnings are used.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain why CS-23 and CS-25 require a margin to stall speed for take-off and landing speeds.	X	X						
(04)	X	Describe: — buffet; — stall strip; — flapper switch (leading-edge stall-warning vane); — angle-of-attack vane; — angle-of-attack probe; — stick shaker.	X	X						
(05)		Describe the recovery after: — stall warning; — stall; — stick-pusher actuation.	X	X						
081 03 01 05		**Special phenomena of stall**								
(01)		*Intentionally left blank*								
(02)		Explain the difference between power-off and power-on stalls and recovery.	X	X						
(03)		Describe stall and recovery in a climbing and descending turn.	X	X						
(04)		Describe the pitch-up effect on a swept wing aeroplane and also an aeroplane with a T-tail.	X	X						
(05)		Describe super stall or deep stall.	X	X						
(06)		Describe the philosophy behind the stick-pusher system.	X	X						
(07)		Describe the factors that can lead to the absence of stall warning and explain the associated risks.	X	X						
(08)		Describe the indications and explain the consequences of premature stabiliser stall due to ice contamination (negative tail stall).	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(09)		Describe when to expect in-flight icing.	X	X						
(10)		Explain how the effect is changed when retracting/extending lift-augmentation devices.	X	X						
(11)		*Intentionally left blank*	X	X						
(12)		Explain the effect of a contaminated wing on the stall speed and αCRIT.	X	X						
(13)		Explain the hazards associated with airframe contamination when parked and during ground operations in winter conditions, and the aerodynamic effects when attempting a take-off.	X	X						
(14)		Explain de-icing/anti-icing holdover time and the likely hazards after it has expired.	X	X						
(15)		Describe the aerodynamic effects of heavy tropical rain on stall speed and drag, and the appropriate mitigation in such conditions.	X	X						
081 03 01 06		***The spin***								
(01)		Explain how to avoid spins.	X	X						
(02)		List the factors that cause a spin to develop.	X	X						
(03)		Describe an 'incipient' and 'developed' spin, recognition and recovery.	X	X						
(04)		Describe the differences in spin attitude with forward and aft CG.	X	X						
081 03 02 00		**Buffet onset boundary**								
081 03 02 01		***Mach buffet***								
(01)		Explain shock-induced separation, and describe its relationship with Mach buffet (high speed buffet) and Mach tuck.	X							
(02)		*Intentionally left blank*								
081 03 02 02		***Buffet onset***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the concept of buffet margin, and describe the influence of the following parameters on the concept of buffet margin: — α; — Mach number; — pressure altitude; — mass; — load factor; — angle of bank; — CG location.	X							
(02)		Explain how the buffet onset boundary chart can be used to determine: — manoeuvrability; — buffet margin.	X							
(03)		Describe the consequences of exceeding M_{MO}: light buffet, buffet onset.	X							
(04)		Explain ‘aerodynamic ceiling’ and ‘coffin corner’.	X							
(05)		Explain the concept of the ‘1.3g’ buffet margin altitude.	X							
(06)		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.	X							
(07)		Explain why descent increases the buffet free range.	X							
081 03 03 00		**Situations in which buffet or stall could occur**								
081 03 03 01		**Explain why buffet or stall occurs**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain why buffet or stall could occur in the following pilot-induced situations, and the methods to mitigate them: — inappropriate take-off configuration, detailing the consequences of errors associated with leading-edge devices; — steep turns; — go-around using take-off/go-around (TOGA) setting (underslung engines).	X	X						
(02)		Explain why buffet or stall could occur in the following environmental conditions at low altitude, and how to mitigate them: — thunderstorms; — wind shear and microburst; — turbulence; — wake turbulence; — icing conditions.	X	X						
(03)		Explain why buffet or stall could occur in the following environmental conditions at high altitude, and how to mitigate them: — thunderstorms in the intertropical convergence zone (ITCZ); — jet streams; — clear-air turbulence.	X							
(04)		Explain why buffet or stall could occur in the following situations, and how to mitigate them: — inappropriate autopilot climb mode; — loss of, or unreliable, airspeed indication.	X	X						
081 03 04 00		**Recognition of stalled condition**								
081 03 04 01		***Recognition and explanation of stalled condition***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain why a stalled condition can occur at any airspeed, or attitude or altitude.	X	X						
(02)		Explain that a stall may be recognised by continuous stall-warning activation accompanied by at least one of the following: — buffet, that can be heavy; — lack of pitch authority; — uncommanded pitch down and uncommanded roll; — inability to arrest the descent rate.	X	X						
(03)		Explain that 'stall warning' means a natural or synthetic indication provided when approaching the stall that may include one or more of the following indications: — aerodynamic buffeting; — reduced roll stability and aileron effectiveness; — visual or aural clues and warnings; — reduced elevator (pitch) authority; — inability to maintain altitude or arrest a rate of descent; — stick-shaker activation.	X	X						
081 04 00 00		**STABILITY**								
081 04 01 00		**Static and dynamic stability**								
081 04 01 01		***Basics and definitions***								
(01)		Define 'static stability': — describe/identify a statically stable, neutral, and unstable condition (positive, neutral, and negative static stability), and — explain why aeroplanes are statically stable.	X	X						
(02)		Explain manoeuvrability.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the relationship between static stability and manoeuvrability.	X	X						
(04)		Define 'dynamic stability': — describe/identify a dynamically stable, neutral, and unstable motion (positive, neutral, and negative dynamic stability); — describe/identify periodic and aperiodic motion.	X	X						
(05)		*Intentionally left blank*								
081 04 01 02		***Precondition for static stability***								
(01)	X	Explain an equilibrium of forces and moments as the initial condition for static stability.	X	X						
081 04 01 03		***Sum of forces***								
(01)	X	Identify the forces considered in the equilibrium of forces.	X	X						
081 04 01 04		***Sum of moments***								
(01)		Identify the moments about all three axes considered in the equilibrium of moments.	X	X						
(02)		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***								
(01)	X	Explain the stabiliser as the means to satisfy the condition of nullifying the total sum of the moments about the lateral axis.	X	X						
(02)		Explain the influence of the location of the wing CP relative to the CG on the magnitude and direction of the balancing force on the stabiliser.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the influence of the indicated airspeed on the magnitude and direction of the balancing force on the stabiliser.	X	X						
(04)		Explain the use of the elevator deflection or stabiliser angle for the generation of the balancing force and its direction.	X	X						
(05)		Explain the elevator deflection required to balance thrust change as a function of engine position.	X	X						
081 04 03 02		***Static longitudinal stability***								
(01)		Discuss the effect of the CG location on pitch manoeuvrability and longitudinal stability.	X	X						
081 04 03 03		***Neutral point***								
(01)	X	Define 'neutral point'.								
(02)	X	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***								
(01)		Describe the location of the neutral point relative to the locations of the aerodynamic centre of the wing and tail.	X	X						
081 04 03 05		***Location of centre of gravity (CG)***								
(01)		Explain the influence of the CG location on the static longitudinal stability of the aeroplane.	X	X						
(02)		Explain the CG forward and aft limits with respect to: longitudinal control forces; elevator effectiveness; stability.	X	X						
(03)		Define 'static margin'.	X	X						
081 04 03 06		***The C_m– α graph***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Describe the C_m–α graph with respect to the relationship between the slope of the graph and static stability.	X	X						
081 04 03 07		***Factors affecting the C_m–α graph***								
(01)		Explain: — the effect on the C_m–α graph of a shift of CG in the forward and aft direction; — the effect on the C_m–α graph when the elevator is moved up or down; — the effect on the C_m–α graph when the trim is moved; — the effect of the wing contribution; — the tail contribution.	X	X						
081 04 03 08		***Intentionally left blank***								
081 04 03 09		***Intentionally left blank***								
081 04 03 10		***The stick force versus speed graph (IAS)***								
(01)		Explain how a pilot perceives stable static longitudinal stick force stability regarding changes in: — speed; — altitude; — mass distribution (CG location).	X	X						
081 04 03 11		***Intentionally left blank***								
081 04 03 12		***The manoeuvring stability/stick force per g***								
(01)	X	Define the ‘stick force per g’, and describe that the stick force increases linearly with increase in g.	X	X						
(02)		Explain why: — the stick force per g has a prescribed minimum and maximum value; — the stick force per g decreases with pressure altitude.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 04 03 13		***Intentionally left blank***								
081 04 03 14		***Factors affecting the manoeuvring stability/stick force per g***								
(01)		Explain the influence on stick force per g of: — CG location; — trim setting.	X	X						
081 04 03 15		***Intentionally left blank***								
081 04 03 16		***Dynamic longitudinal stability***								
(01)		Describe the phugoid and short-period motion in terms of period, damping, variations (if applicable) in speed, altitude, and α.	X	X						
(02)		Explain why the short-period motion is more hazardous than the phugoid.	X	X						
(03)		Describe 'pilot-induced oscillations'.	X	X						
(04)		Explain the effect of high altitude on dynamic stability.	X	X						
(05)		Describe the influence of the CG location on the dynamic longitudinal stability of the aeroplane.	X	X						
081 04 04 00		**Static directional stability**								
081 04 04 01		***Definition and effects of static directional stability***								
(01)	X	Define 'static directional stability'.	X	X						
(02)		Explain the effects of static directional stability being too weak or too strong.	X	X						
081 04 04 02		***Sideslip angle***								
(01)		Define 'sideslip angle'.	X	X						
(02)		Identify β as the symbol used for the sideslip angle.	X	X						
081 04 04 03		***Yaw-moment coefficient C_n***								
(01)	X	Define the 'yawing-moment coefficient C_n'.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)	X	Define the relationship between C_n and β for an aeroplane with static directional stability.	X	X						
081 04 04 04		***C_n–β graph***								
(01)	X	Explain why: — Cn depends on β; — Cn equals zero for that β that provides static equilibrium about the aeroplane's normal axis; — if no asymmetric engine thrust, flight control or loading condition prevails, the equilibrium β equals zero.	X	X						
(02)	X	Identify how the slope of the Cn–β graph is a measure for static directional stability.	X	X						
(03)	X	Identify how the slope of the Cn–β graph is affected by altitude.	X	X						
081 04 04 05		***Factors affecting static directional stability***								
(01)		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 α; — strakes.	X	X						
(02)		Explain the reduction in static directional stability when the CG moves aft	X	X						
081 04 05 00		**Static lateral stability**								
081 04 05 01		***Definition and effects of static lateral stability***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Define 'static lateral stability'.	X	X						
(02)		Explain the effects of static lateral stability being too weak or too strong.	X	X						
081 04 05 02		***Bank angle Ø***								
(01)	X	Define 'bank angle Ø'.	X	X						
081 04 05 03		***The roll-moment coefficient C_l***								
(01)	X	Define the 'roll-moment coefficient C_l'.	X	X						
081 04 05 04		***Contribution of sideslip angle (β)***								
(01)		Explain how without coordination the bank angle (Ø) creates sideslip angle (β).	X	X						
081 04 05 05		***The C_l–β graph***								
(01)	X	Describe the C_l–β graph.	X	X						
(02)	X	Identify the slope of the C_l– β graph as a measure for static lateral stability.	X	X						
(03)	X	Identify how the slope of the C_l–β graph is affected by altitude.	X	X						
081 04 05 06		***Factors affecting static lateral stability***								
(01)		Explain the contribution to the static lateral stability of: — dihedral, anhedral; — high wing, low wing; — sweep angle of the wing; — ventral fin; — vertical tail.	X	X						
081 04 06 00		**Dynamic lateral/directional stability**								
081 04 06 01		***Intentionally left blank***								
081 04 06 02		***Tendency to spiral dive***								
(01)		Explain how lateral and directional stability are coupled.	X	X						
(02)		Explain how high static directional stability and low static lateral stability may cause spiral divergence (unstable spiral dive),	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		and under which conditions the spiral dive mode is neutral or stable.								
(03)		Describe an unstable spiral dive mode with respect to deviations in speed, bank angle, nose low-pitch attitude, and decreasing altitude.	X	X						
081 04 06 03		***Dutch roll***								
(01)		Describe Dutch roll.	X	X						
(02)		Explain: — why Dutch roll occurs when the static lateral stability is higher than static directional stability; — the conditions for a stable, neutral or unstable Dutch roll motion; — the function of the yaw damper; — the actions to be taken when the yaw damper is not available.	X	X						
(03)		Describe how the asymmetric nature of shock waves on both wings, at high Mach numbers, can lead to Dutch roll.	X							
081 04 06 04		***Effects of altitude on dynamic stability***								
(1)		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***								
(01)	X	Define: — lateral axis; — longitudinal axis; — normal axis.	X	X						
(02)	X	Define: — pitch angle;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— bank angle (Ø); — yaw angle.								
(03)		Describe the motion about the three axes.	X	X						
(04)		Name and describe the devices that control these motions.	X	X						
081 05 01 02		***Camber change***								
(01)		State that camber is changed by movement of a control surface and explain the effect.	X	X						
081 05 01 03		***Angle-of-attack (α) change***								
(01)	X	Explain the influence of local α change by movement of a control surface.	X	X						
081 05 02 00		**Pitch (longitudinal) control**								
081 05 02 01		***Elevator/all-flying tails***								
(01)		Explain the working principle of the elevator/all-flying tail and describe its function.	X	X						
081 05 02 02		***Downwash effects***	X	X						
(01)		Explain the effect of downwash on the tailplane α.	X	X						
(02)		Intentionally left blank								
081 05 02 03		***Intentionally left blank***								
081 05 02 04		***Location of centre of gravity (CG)***								
(01)		Explain the relationship between elevator deflection and CG location to produce a given aeroplane response.	X	X						
(02)		Explain the effect of forward CG limit on pitch control.	X	X						
081 05 02 05		***Moments due to engine thrust***								
()1)		Describe the effect of engine thrust on pitching moments for different engine locations.	X	X						
081 05 03 00		**Yaw (directional) control**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 05 03 01		***The rudder***								
		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 02		***Rudder limiting***								
(01)		Explain why and how rudder deflection is limited on CAT aeroplanes.	X							
081 05 04 00		**Roll (lateral) control**								
081 05 04 01		***Ailerons***								
(01)		Explain the functioning of ailerons.	X	X						
(02)		Describe the adverse effects of aileron deflection. (Refer to Subjects 081 05 04 04 and 081 06 01 02)	X	X						
(03)		Explain why some aeroplanes have inboard and outboard ailerons.	X	X						
(04)		State that the outboard ailerons are locked beyond a given speed to prevent: — over-control; — exceeding structural limitations; — aeroelastic phenomena (flutter, divergence and aileron reversal).	X	X						
(05)		Describe the use of aileron deflection in normal flight, flight with sideslip, crosswind landings, horizontal turns, flight with one-engine-inoperative.	X	X						
(06)	X	Define ‘roll rate’.	X	X						
(07)	X	List the factors that affect roll rate.	X	X						
(08)		Describe flaperons and aileron droop.	X	X						
081 05 04 02		***Intentionally left blank***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 05 04 03		***Spoilers***								
(01)		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***								
(01)		Explain why the use of ailerons induces adverse yaw.	X	X						
081 05 04 05		***Means to avoid adverse yaw***								
(01)		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**								
081 05 05 01		***Explain roll/yaw interaction***								
(01)		Explain the secondary effect of roll.	X	X						
(02)		Explain the secondary effect of yaw.	X	X						
081 05 06 00		**Means to reduce control forces**								
081 05 06 01		***Aerodynamic balance***								
(01)		Describe the purpose of aerodynamic balance.	X	X						
(02)		Describe the working principle of the horn balance.	X	X						
(03)		Describe the working principle of the internal balance.	X	X						
(04)		Describe the working principle and application of: — balance tab; — anti-balance tab; — spring tab; — servo tab.	X	X						
081 05 06 02		***Artificial means***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the differences between fully powered controls and power-assisted controls.	X	X						
(02)		Describe power-assisted controls.	X	X						
(03)		Describe the advantages of artificial feel in fully powered control.	X	X						
081 05 07 00		**Fly-by-wire (FBW)**								
081 05 07 01		***Control laws***								
(01)		Explain which parameters may be controlled in level flight with the pitch control law.	X							
(02)		Explain the advantages of using the CG position in the FBW system.	X							
(03)		Explain what type of flight-degraded control laws may be available in case of failure.	X							
(04)		Explain what are hard and soft protections.	X							
081 05 08 00		**Trimming**								
081 05 08 01		***Reasons to trim***								
(01)		State the reasons for using trimming devices.	X	X						
(02)		Explain the difference between a trim tab and the various balance tabs.	X	X						
081 05 08 02		***Trim tabs***								
(01)		Describe the working principle of a trim tab including cockpit indications.	X	X						
081 05 08 03		***Stabiliser trim***								
(01)		Describe the working principle of stabiliser trim including the flight deck indications.	X	X						
(02)		Explain the advantages and disadvantages of a stabiliser trim compared to a trim tab.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain the relationship between CG position, take-off trim setting, and stabiliser trim position.	X	X						
(04)		Explain the effect of errors in the take-off stabiliser trim setting on the rotation characteristics and stick force during take-off rotation.	X	X						
(05)		Discuss the effects of jammed and runaway stabiliser.	X	X						
(06)		Explain the consequences of a jammed stabiliser during take-off, landing, and go-around.	X	X						
081 06 00 00		**LIMITATIONS**								
081 06 01 00		**Operating limitations**								
081 06 01 01		***Flutter***								
(01)		Describe the phenomenon of flutter and how IAS and mass distribution affects the likelihood of flutter occurrence.	X	X						
(02)		Describe the use of mass balance to alleviate the flutter problem by adjusting the mass distribution: — wing-mounted engines on pylons; — control surface mass balance.	X	X						
(03)		Explain what is the flight envelope free of flutter.	X	X						
081 06 01 02		***Intentionally left blank***								
(01)		*Intentionally left blank*								
081 06 01 03		***Landing gear/flap operating***								
(01)		Describe the reason for flap/landing gear limitations. Define 'V_{LO}'. Define 'V_{LE}'.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain why there is a difference between V_{LO} and V_{LE} in the case of some aeroplane types.	X	X						
(03)		Define 'VFE' and describe flap limiting speeds.	X	X						
(04)		Describe flap design features, procedures and warnings to prevent overload.	X	X						
081 06 01 04		***V_{MO}, V_{NO}, and V_{NE}***								
(01)	X	Define 'V_{MO}', 'V_{NO}', and 'V_{NE}'.	X	X						
(02)		Explain the significance of V_{MO}, V_{NO} and V_{NE}, and the differences between these airspeeds.	X	X						
(03)		Explain the hazards of flying at speeds above V_{NE} and V_{MO}.	X	X						
081 06 01 05		***M_{MO}***								
(01)		Define 'M_{MO}' and state its limiting factors.								
081 06 02 00		**Manoeuvring envelope**								
081 06 02 01		***Manoeuvring–load diagram***								
(01)		Describe the manoeuvring–load diagram.	X	X						
(02)		Define limit and ultimate load factor, and explain what can happen if these values are exceeded.	X	X						
(03)		Define 'V_A', 'V_B', 'V_C', and 'V_D'.	X	X						
(04)		Identify and explain the varying features on the V_N diagram: — load factor 'n'; — speed scale, equivalent airspeed; — equivalent airspeed envelope; — 1g stall speed; — stall boundary (refer to 081 03 01 02).	X	X						
(05)		Describe the relationship between V_{MO} or V_{NE} and V_C.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		State all the manoeuvring load-factors limits applicable to CS-23 and CS-25 aeroplanes.	X	X						
(07)		Explain the relationship between V_A and V_S in a formula, and calculate the values.	X	X						
(08)		Explain the significance of V_A and the adverse consequences of applying full, abrupt nose-up elevator deflection when exceeding V_A.	X	X						
081 06 02 02		**Factors affecting the manoeuvring–load diagram**								
(01)		State the relationship of mass to load-factor limits and accelerated stall speed boundary limit.	X	X						
(02)		Calculate the change of V_A with changing mass.	X	X						
(03)		Explain why V_A loses significance at higher altitude.	X							
(04)	X	Define 'M_C' and 'M_D'.	X							
081 06 03 00		**Gust envelope**								
081 06 03 01		***Gust–load diagram***								
(01)		Recognise a typical gust–load diagram, and state the minimum gust speeds in ft/s, m/s and kt that the aeroplane must be designed to withstand at V_B to V_C and V_D.	X	X						
(02)		Discuss considerations for the selection of V_{RA}.	X	X						
(03)		Explain the adverse effects on the aeroplane when flying in turbulence.	X	X						
081 06 03 02		***Factors affecting the gust–load diagram***								
(01)		Describe and explain the relationship between the gust–load factor and the following: lift–curve slope, aspect ratio,	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		angle of sweep, altitude, wing loading, weight, wing area, equivalent airspeed (EAS), and speed of vertical gust. (Note: For examination purposes, the ECQB questions will not be calculation based.)								
081 07 00 00		**PROPELLERS**								
081 07 01 00		**Conversion of engine torque to thrust**								
081 07 01 01		***Explain conversion of aerodynamic force on a propeller blade***								
(01)		Explain the resolution of aerodynamic force on a propeller blade element into lift and drag or into thrust and torque.	X	X						
(02)		Describe how propeller thrust and aerodynamic torque vary with IAS.	X	X						
081 07 01 02		***Relevant propeller parameters***								
(01)		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.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe how the terms 'fine pitch' and 'coarse pitch' can be used to express blade angle.	X	X						
081 07 01 03		***Blade twist***								
(01)	X	Define 'blade twist'.	X	X						
(02)		Explain why blade twist is necessary.	X	X						
081 07 01 04		***Fixed pitch and variable pitch/constant speed***								
(01)	X	List the different types of propellers: — fixed pitch; — adjustable pitch or variable pitch (non-governing); — variable pitch (governing)/constant speed.	X	X						
(02)		Discuss the advantages and disadvantages of fixed-pitch and constant-speed propellers.	X	X						
(03)		Discuss climb and cruise propellers.	X	X						
(04)		Explain the relationship between blade angle, blade angle of attack, and airspeed for fixed and variable pitch propellers.	X	X						
(05)		Describe and explain the forces that act on a rotating blade element in normal, feathered, windmilling, and reverse operation.	X	X						
(06)		Explain the effects of changing propeller pitch at constant IAS.	X	X						
081 07 01 05		***Propeller efficiency versus speed***								
(01)		Define 'propeller efficiency'.	X	X						
(02)		Explain and describe the relationship between propeller efficiency and speed (TAS) for different types of propellers.	X	X						
(03)		Explain the relationship between blade angle and thrust.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 07 01 06		***Effects of ice on propeller***								
(01)		Describe the effects and hazards of ice on a propeller.	X	X						
081 07 02 00		**Engine failure**								
081 07 02 01		***Windmilling drag***								
(01)		Describe 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***								
(01)		Explain the reasons for feathering a propeller, including the effect on the yaw moment, performance and controllability.	X	X						
081 07 03 00		**Design features for power absorption**								
081 07 03 01		***Propeller design characteristics that increase power absorption***								
(01)	X	Name the propeller design characteristics that increase power absorption.	X	X						
081 07 03 02		***Diameter of propeller***								
(01)		Explain the reasons for restricting propeller diameter.	X	X						
081 07 03 03		***Number of blades***								
(01)	X	Define ‘solidity’.	X	X						
(02)		Describe the advantages and disadvantages of increasing the number of blades.	X	X						
081 07 03 04		***Propeller noise***								
(01)	X	Describe how propeller noise can be minimised.	X	X						
081 07 04 00		**Secondary effects of propellers**								
081 07 04 01		***Torque reaction***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Describe the effects of engine/propeller torque.	X	X						
(02)		Describe the following methods for counteracting engine/propeller torque: — counter-rotating propellers; — contra-rotating propellers.	X	X						
081 07 04 02		***Gyroscopic precession***								
(01)	X	Describe what causes gyroscopic precession.	X	X						
(02)	X	Describe the effect on the aeroplane due to the gyroscopic effect.	X	X						
081 07 04 03		***Slipstream effect***								
(01)		Describe the possible effects of the rotating propeller slipstream.	X	X						
081 07 04 04		***Asymmetric blade effect***								
(01)		Explain the asymmetric blade effect (also called P factor).	X	X						
(02)		Explain the influence of direction of rotation on the critical engine on twin-engine aeroplanes.	X	X						
081 07 04 05		***Consideration of propeller effects***								
(01)		Describe, given direction of propeller rotation, the propeller effects during take-off run, rotation and initial climb, and their consequence on controllability.	X	X						
(02)		Describe, given the direction of propeller rotation, the propeller effects during a go-around and their consequence on controllability.	X	X						
(03)		Explain how the propeller effects during go-around can be affected by: high engine performance conditions and their effect on the VMC speeds; loss of the critical engine; crosswind; high flap setting;	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
081 08 00 00		**FLIGHT MECHANICS**								
081 08 01 00		**Forces acting on an aeroplane**								
081 08 01 01		***Straight, horizontal, steady flight***								
(01)	X	Describe the forces that act on an aeroplane in straight, horizontal, and steady flight.	X	X						
(02)	X	List the four forces and state where they act on.	X	X						
(03)		Explain how the four forces are balanced, including the function of the tailplane.	X	X						
081 08 01 02		***Straight, steady climb***								
(01)	X	Define 'flight-path angle' (γ).	X	X						
(02)		Describe the relationship between pitch attitude, γ and α for zero-wind and zero-bank conditions.	X	X						
(03)	X	Describe the forces that act on an aeroplane in a straight, steady climb.	X	X						
(04)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula relating to the parallel forces (T = D + W sin γ). — Apply the formula relating to the perpendicular forces (L = W cos γ).	X	X						
(05)		Explain why thrust is greater than drag.	X	X						
(06)		Explain why lift is less than weight.	X	X						
(07)		Explain the formula (for small angles) that gives the relationship between γ, thrust, weight, and lift–drag ratio, and use this formula for simple calculations.	X	X						
(08)		Explain how IAS, α, and γ change in a climb performed with constant vertical speed and constant thrust setting.	X	X						
081 08 01 03		***Straight, steady descent***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)	X	Describe the forces that act on an aeroplane in a straight, steady descent.	X	X						
(02)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula for forces parallel to the direction of flight ($T = D – W \sin \gamma$). — Apply the formula relating to the perpendicular forces ($L = W \cos \gamma$).	X	X						
(03)		Explain why lift is less than weight.	X	X						
(04)		Explain why thrust is less than drag.	X	X						
081 08 01 04		***Straight, steady glide***								
(01)	X	Describe the forces that act on an aeroplane in a straight, steady glide.	X	X						
(02)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula for forces parallel to the direction of flight ($D = W \sin \gamma$). — Apply the formula for forces perpendicular to the direction of flight ($L = W \cos \gamma$).	X	X						
(03)		Describe the relationship between the glide gradient and the lift–drag ratio, and calculate glide range given: — initial height; — L-D ratio; — glide speed and wind speed.	X	X						
(04)		Define VMD (speed for minimum drag) and explain the relationship between α, VMD and the best lift–drag ratio.	X	X						
(05)		Explain the effect of wind component on glide angle, duration, and distance.	X	X						
(06)		Explain the effect of mass change on glide angle, duration, and distance, given that	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		the aeroplane remains at either the same airspeed or at VMD.								
(07)		Explain the effect of configuration change on glide angle and duration.	X	X						
(08)		Describe the relation between TAS, gradient of descent, and rate of descent.	X	X						
(09)		Define VMP (speed for minimum power) and describe that the minimum rate of descent in the glide will be at VMP, and explain the relationship of this speed to the optimum speed for minimum glide angle.	X	X						
(10)		Discuss when a pilot could elect to fly for minimum glide rate of descent or minimum glide angle, and why speed stability or headwinds/tailwinds may favour a speed that is faster or slower than the optimum airspeed in still air.	X	X						
081 08 01 05		***Steady, coordinated turn***								
(01)		Describe the forces that act on an aeroplane in a steady, coordinated turn.	X	X						
(02)		Resolve the forces that act horizontally and vertically during a coordinated turn ($tan\emptyset = \frac{V^2}{gR}$).	X	X						
(03)		Describe the difference between a coordinated and an uncoordinated turn, and describe how to correct an uncoordinated turn using turn and slip indicator or turn coordinator.	X	X						
(04)		Explain why the angle of bank is independent of mass, and that it only depends on TAS and radius of turn.	X	X						
(05)		Resolve the forces to show that for a given angle of bank the	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		radius of turn is determined solely by airspeed ($tan\emptyset = \frac{V^2}{gR}$).								
(06)		Calculate the turn radius of a steady turn given TAS and angle of bank.	X	X						
(07)		Explain the effects of bank angle on: — load factor (LF = 1/cos ∅); — α; — thrust; — drag.	X	X						
(08)	X	Define 'angular velocity'.	X	X						
(09)	X	Define 'rate of turn' and 'rate-1 turn'.	X	X						
(10)		Explain the influence of TAS on rate of turn at a given bank angle.	X	X						
(11)		Calculate the load factor and stall speed in a turn given angle of bank and 1g stall speed.	X	X						
(12)		Explain situations in which turn radius is relevant for safety, such as maximum speed limits on departure or arrival plates, or outbound speed categories on approach plates, and the implications/hazards of exceeding given speeds.	X	X						
(13)		Describe the hazards of excessive use of rudder to increase the rate of turn in a swept-wing aeroplane.	X	X						
081 08 02 00		**Asymmetric thrust**								
081 08 02 01		***Jet-engined and propeller-driven aeroplanes***								
(01)		Describe the effects on the aeroplane of asymmetric thrust during flight, for both jet-engined and propeller-driven aeroplanes.	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain critical engine, and explain, for a propeller-driven aeroplane, the effect of the direction of propeller rotation.	X	X						
(03)	X	Explain the effect of steady, asymmetric flight on a conventional (ball) slip indicator/turn indicator.	X	X						
(04)		Explain the effect of a crosswind on asymmetric flight.	X	X						
081 08 02 02		***Balanced moments about the normal axis***								
(01)		Explain the yaw moments about the CG.	X	X						
(02)		Explain the change to the yaw moment caused by the effect of air density on thrust.	X	X						
(03)		Describe the changes to the yaw moment caused by engine distance from CG.	X	X						
(04)		Describe the methods to achieve directional balance following engine loss.	X	X						
081 08 02 03		***Forces parallel to the lateral axis***								
(01)		Explain: — the force on the vertical fin; — the fuselage side force due to sideslip (using wing-level method); — the use of bank angle to tilt the lift vector (in wing-down method).	X	X						
(02)		Explain: — α; — side slip; — loads on the fin; — α on the fin.	X	X						
(03)		Explain the effect on fin α due to sideslip.	X	X						
081 08 02 04		***Influence of aeroplane mass***								
(01)		Explain why controllability with one-engine-inoperative is a typical problem	X	X						

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		arising from the low speeds associated with low aeroplane mass.								
081 08 02 05		***Intentionally left blank***								
081 08 02 06		***Intentionally left blank***								
081 08 02 07		***Intentionally left blank***								
081 08 02 08		***Minimum control speed (V_{MC})***								
(01)		Define 'V_{MC}'	X	X						
(02)		Describe how V_{MC} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 09		***Minimum control speed during approach and landing (V_{MCL})***								
(01)		Define 'V_{MCL}'.	X	X						
(02)		Describe how V_{MCL} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 10		***Minimum control speed on the ground (V_{MCG})***								
(01)		Define 'V_{MCG}'.	X	X						
(02)		Describe how V_{MCG} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 11		***Influence of density***								
(01)		Describe the influence of density on thrust during asymmetric flight.	X	X						
(02)		Explain why V_{MC}, V_{MCL} and V_{MCG} reduce with reduction in thrust.	X	X						
081 08 03 00		**Significant points on a polar curve**								
081 08 03 01		***Identify and explain***								
(01)		Identify and explain the significant points on a polar curve.	X	X						

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SUBJECT 082 – PRINCIPLES OF FLIGHT – HELICOPTERS

(1) VOCABULARY OF MECHANICS

Speed is a scalar quantity; it has only magnitude.

Velocity is a vector quantity with magnitude and direction.

The velocity of a point on a rotor blade, when rotating around an axis, is the 'linear' or 'tangential' velocity which can be expressed in revolutions per minute (rpm).

Density is the mass of the fluid per unit volume (kg/m3) in the international system of units of measurement (SI (Système International)).

(2) AERONAUTICAL DEFINITIONS

A rotor blade is a high-aspect ratio aerofoil attached by its root to the rotor hub with hinges or flexible elements.

A blade element is a spanwise slice of the blade, so thin that the aerodynamic forces involved may be assumed not to vary. The forces produce lift (L), drag (D), and a pitching moment. Such a cross section has a contour, a leading and trailing edge, a chord line, a mean camber line, a maximum thickness or depth, and a thickness-to-chord ratio.

The centre of pressure (CP) is defined as the point on the chord line where the resultant of all aerodynamic forces acts.

The planform is the shape of a blade as seen from above.

The pitch angle (of a blade or an element) is the angle between the chord line and the plane of rotation.

The blade is not twisted when the pitch angle is constant from root to tip.

A blade is twisted when the pitch angle of its elements' sections varies with their distance from the root (in other words, the chord lines of the elements involved are not parallel). Washout exists when the pitch angle decreases towards the blade tip.

The vector sum of the undisturbed upstream velocity (i.e. that found in the plane of rotation of the blades) and the induced velocity is the relative airflow.

The angle between the relative airflow and the chord line of a blade element is the angle of attack (α).

Lift is the component of the aerodynamic force on a blade element that is perpendicular to the relative airflow.

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Profile drag is the component of the aerodynamic force on a blade element that is parallel to the plane of rotation. Induced drag is the component of the aerodynamic force on a blade element that is parallel to the relative airflow.

Profile drag consists of pressure forces and skin friction acting on the surface of the blade element. The component of profile drag that arises from pressure forces (between the leading and trailing edges) is pressure or form drag. The component of profile drag due to shear forces over the surface is skin friction.

The total rotor thrust is the vertical upwards force from the rotor disc as a whole, as the sum of all the blade thrusts. This term has been reinstated because there is already the term 'rotor thrust' that is used to denote the thrust along the axis of rotation that acts directly opposite the weight of the helicopter in a blade element.

(3) HELICOPTER CHARACTERISTICS

Disc loading is the mass (M) of the helicopter divided by the area of the disc.

Blade loading is the mass divided by the total planform area of the blades.

The area of a rectangular blade is given by the chord multiplied by the blade tip radius. For tapered blades, the mean geometric chord is taken as an approximately equivalent chord.

Rotor solidity is the ratio of the total blade area to the disc area.

(4) PLANES, AXES AND REFERENCE SYSTEMS OF THE ROTOR

— Shaft axis: The physical axis of the rotor shaft (mast).

— Hub plane: A plane perpendicular to the shaft axis through the centre of the hub.

— Tip path plane: The plane traced out by the blade tips.

— Virtual rotation axis: The axis through the centre of the hub and perpendicular to 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 that acts through the hub centre.

(5) ANGLES OF THE BLADES, INDUCED VELOCITY

— Pitch angle of a blade element: The angle between the chord line of the element and its plane of rotation, sometimes called 'local pitch angle'.

— Blade pitch angle: Taken to be equivalent to the pitch angle of the blade element found at 75 % of the blade radius.

— Flapping angle: The angle between the longitudinal axis of the blade and the hub plane.

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— Coning angle: The angle between the longitudinal axis of the blade and the tip path plane. Induced velocity is that induced by the engine power perpendicular to the plane of rotation.

Aerodynamic forces on the blades and the rotor

The thrust from a blade (blade thrust) is the sum of the thrusts from each blade element.

The sum of the thrusts from all blades is the (total) rotor thrust acting perpendicular to the tip path 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 blade, gives the required induced power.

The result of the profile drag forces is a torque on the shaft which, multiplied by the angular velocity of the blade, gives the required profile power.

(6) 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, and the head is underslung. 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 (Bell 47). It is sometimes called semi-rigid because there is no movement of the blade in a drag-wise sense.
2. Fully articulated rotor: There are more than two rotor blades and each has a flapping hinge, a lead-lag (drag) hinge, and a feathering hinge or bearing.
3. Hingeless rotor: There are no flapping or dragging hinges. They are replaced by flexible elements (virtual hinges) at some part of the blade radius which allow such movements. A feathering bearing allows feathering of the blade.
4. Bearingless rotor: There are no hinges or rotating bearings. Flapping and dragging movements are obtained with flexible elements called elastomeric hinges. Feathering is obtained by twisting the element.

When referring to their equipment, Airbus call this a 'semi-articulated head' (ref.: their training material).

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. Hingeless and bearingless rotors have an equivalent hinge offset.

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2. Elastomeric hinges

This bearing consists of alternate layers of elastomer and metal. The flexibility of the elastomer allows flapping, dragging and feathering.

(7) DRAG AND POWERS

Induced power is that required to generate the induced velocity in the rotor disc for the production of lift. For any given thrust, induced power is minimum when the induced velocity is uniform over the rotor disc. This can be approximated by using washout and ensuring that the blades are in track (a truly uniform velocity cannot be obtained).

Rotor profile drag results from those components acting in the opposite direction to the blade velocities (i.e. the sum of all the profile drags from each blade element). The power required to overcome it is rotor profile power (the sum of the powers required to overcome the torque).

Parasite drag is the drag from the helicopter fuselage including that from the rotor hub and all external equipment such as wheels, the winch, external loads, etc. (any drag from the tail rotor is included, but not from the rotor blades, which produce profile drag). The power to overcome this drag is parasite power.

In level flight at constant speed, induced power, rotor profile power and parasite power are summed to give the total power required to drive the main rotor.

Induced power and profile power for the tail rotor are summed to give the power required to drive the tail rotor.

The power required to drive auxiliary services, such as oil pumps and electrical generators, is called accessory or ancillary power. It includes the power required to overcome mechanical friction in transmissions.

The total power required in level flight at constant speed is the sum of all the above.

When transitioning from the hover, the power required decreases as speed increases. This is called translational lift.

The term limited power means that the total power required to hover out of ground effect (HOGE) is greater than the available power.

(8) PHASE ANGLE IN FLAPPING MOVEMENT OF THE BLADE

The movement of the cyclic control tilts the rotor disc in the direction of the intended movement of the helicopter.

For teetering heads, the flapping response is 90° later than the applied cyclic control movement (less than 90° for rotors with offset hinges).

The pitch mechanism consists of the swash plate, and for each blade the pitch mechanism consists of a pitch link attached to the swash plate and a pitch horn attached to the blade.

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(9) AXES THROUGH THE CENTRE OF THE HELICOPTER

Longitudinal axis or roll axis: A straight line through the centre of gravity (CG) 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: A straight line through the CG 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, which is the plane either side of which the components that constitute the major part of the aircraft are symmetrically disposed in the port and starboard sense).

Normal axis or yaw axis: A straight line perpendicular to the plane defined by the longitudinal and lateral axes and about which the helicopter can yaw.

Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine whether the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
080 00 00 00		**PRINCIPLES OF FLIGHT**								
082 00 00 00		**PRINCIPLES OF FLIGHT — HELICOPTERS**								
082 01 00 00		**SUBSONIC AERODYNAMICS**								
082 01 01 00		**Basic concepts, laws and definitions**								
082 01 01 01		***International system of units of measurement (SI) and conversion of SI units***								
(01)	X	List the fundamental quantities and units in SI, such as mass (kg), length (m), time (s).			X	X	X			
(02)	X	Be able to convert imperial units to SI units and vice versa.			X	X	X			
082 01 01 02		***Definitions and basic concepts of air***								
(01)	X	Describe air temperature and pressure as functions of height.			X	X	X			
(02)	X	Define the International Standard Atmosphere (ISA).			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)	X	Define air density, and explain the relationship between air density, pressure, and temperature.			X	X	X			
(04)	X	Explain the influence of moisture content on air density.			X	X	X			
(05)	X	Define pressure altitude and air density altitude.			X	X	X			
082 01 01 03		***Newton's laws***								
(01)	X	State and interpret Newton's three laws of motion.			X	X	X			
(02)	X	Distinguish between mass and weight, and their units.			X	X	X			
082 01 01 04		***Basic concepts of airflow***								
(01)	X	Describe steady and unsteady airflow.			X	X	X			
(02)	X	Define 'streamline' and 'stream tube'.			X	X	X			
(03)	X	Explain the principle of the continuity equation or the conservation of mass.			X	X	X			
(04)	X	Describe the mass flow rate through a stream tube section.			X	X	X			
(05)		State Bernoulli's equation and use it to explain and define the relationship between static, dynamic and total pressure.			X	X	X			
(06)		Define the stagnation point in the flow around an aerofoil, and explain the pressure obtained at the stagnation point			X	X	X			
(07)		Use the pitot system to explain the measurement of airspeed (no compressibility effects),			X	X	X			
(08)		Define 'TAS', 'IAS', and 'CAS'.			X	X	X			
(09)	X	Define two-dimensional airflow and its relationship to an aerofoil of infinite span (i.e. no blade tip vortices and, therefore, no induced drag). Explain the difference			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		between two- and three-dimensional airflows.								
(10)	X	Explain that viscosity is a feature of any fluid (gas or liquid).			X	X	X			
(11)		Explain the tangential friction between air and the surface of an aerofoil, and the development of a boundary layer.			X	X	X			
(12)		Describe laminar and turbulent boundary layers 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***								
(01)	X	Define the terms: 'aerofoil section', 'aerofoil element', 'chord line', 'chord', 'thickness', 'thickness-to-chord ratio, 'camber line', 'camber', and 'leading-edge radius'.			X	X	X			
(02)		Describe symmetrical and asymmetrical aerofoil sections.			X	X	X			
082 01 02 02		***Aerodynamic forces on aerofoil elements***								
(01)		Define the angle of attack (α).			X	X	X			
(02)		Describe: — the resultant force from the pressure distribution and the friction at the element; — the resultant force from the boundary layers and the velocities in the wake; and — the loss of momentum due to friction forces.			X	X	X			
(03)		Resolve the aerodynamic force into the components of lift (L) and drag (D).			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(04)		Define the lift coefficient (C_L) and the drag coefficient (C_D).			X	X	X			
(05)		Show that the C_L is a function of the α.			X	X	X			
(06)		Explain how drag is caused by pressure forces on the surfaces of an aerofoil and by friction in the boundary layers. Define the term 'profile drag'.			X	X	X			
(07)		Define the L–D ratio.			X	X	X			
(08)		Use the lift and drag equations to show the influence of speed and density on lift and drag for a given α.			X	X	X			
(09)		Define the action line of the aerodynamic force and the CP.			X	X	X			
(10)		Know that symmetrical aerofoils have a CP that is approximately a quarter chord behind the leading edge.			X	X	X			
082 01 02 03		***Stall***								
(01)		Explain the boundary layer separation when α increases beyond the onset of stall and the decrease of lift and the increase of drag. Define the 'separation point'.			X	X	X			
082 01 02 04		***Disturbances due to profile contamination***								
(01)		Explain ice contamination, the modification of the section profile and surfaces due to ice and snow, the influence on L and D and the L–D ratio, the influence on α (at stall onset), and the effect of the increase in weight.			X	X	X			
(02)		Explain the effect of erosion by heavy rain on the blade and subsequent increase in profile drag.			X	X	X			
082 01 03 00		**Three-dimensional airflow around a blade**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
082 01 03 01		***The blade***								
(01)		Describe the various blade planforms.			X	X	X			
(02)		Define aspect ratio and blade twist.			X	X	X			
082 01 03 02		***Airflow pattern and influence on lift (L)***								
(01)		Explain the spanwise flow around a blade and the appearance of blade tip vortices which are a loss of energy.			X	X	X			
(02)		Show that the strength of the vortices increases as α and L increase.			X	X	X			
(03)		Show that downwash causes vortices.			X	X	X			
(04)		Define the relative airflow as the resultant of the undisturbed air velocity and induced velocity, and define α.			X	X	X			
(05)		Explain the spanwise L distribution and the way in which it can be modified by twist (washout).			X	X	X			
082 01 03 03		***Induced drag***								
(01)		Explain induced drag and the influence of α and aspect ratio.			X	X	X			
082 01 03 04		***The airflow around the fuselage***								
(01)		Describe the fuselage and the external components that cause (parasite) drag, the airflow around the fuselage, and the influence of the pitch angle of the fuselage. Describe fuselage shapes that minimise drag.			X	X	X			
(02)		Define profile drag as the sum of pressure (form) drag and skin friction drag.			X	X	X			
(03)		Define ‘interference drag’.			X	X	X			
(04)		Know the drag formula.			X	X	X			
082 02 00 00		**TRANSONIC AERODYNAMICS and COMPRESSIBILITY EFFECTS**								
082 02 01 00		**Airflow speeds and velocities**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
082 02 01 01		***Speeds and Mach number***								
(01)		Define the speed of sound in air.			X	X	X			
(02)		State that the speed of sound is proportional to the square root of the absolute temperature (in Kelvins).			X	X	X			
(03)		Explain the variation in the speed of sound with altitude.			X	X	X			
(04)		Define Mach number.			X	X	X			
(05)		Explain the meaning of incompressibility and compressibility of air; relate this to the value of the Mach number.			X	X	X			
(06)		Define high subsonic, transonic and supersonic flows in relation to the value of the Mach number.			X	X	X			
082 02 01 02		***Shock waves***								
(01)		Describe shock waves in a supersonic flow and the changes in pressure and speed.			X	X	X			
(02)		Describe the appearance of local supersonic flows on the surfaces of a blade.			X	X	X			
082 02 01 03		***Influence of aerofoil section and blade planform***								
(01)		Explain the different shapes that allow higher Mach numbers without generating a shock wave on the upper surface, such as: — reducing the section thickness-to-chord ratio; — a planform with a sweep angle.			X	X	X			
082 03 00 00		**ROTORCRAFT TYPES**								
082 03 01 00		**Rotorcraft**								
082 03 01 01		***Rotorcraft types***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Explain the difference between an autogyro and a helicopter.			X	X	X			
082 03 02 00		**Helicopters**								
082 03 02 01		***Helicopter configurations***								
(01)		Describe (briefly) the single-main-rotor helicopter and other configurations: tandem, coaxial, side-by-side, synchrocopter (with intermeshing blades), the compound helicopter and tilt rotor.			X	X	X			
082 03 02 02		***The helicopter, characteristics and associated terminology***								
(01)		Mention the tail rotor, the Fenestron, and the no tail rotor (NOTAR).			X	X	X			
(02)		Define the rotor disc area and the blade area.			X	X	X			
(03)		Describe the teetering rotor with its hinge axis on the shaft axis, and rotors with more than two blades with offset hinge axes.			X	X	X			
(04)		Define the fuselage centre line and the three axes: roll, pitch, and normal (yaw).			X	X	X			
(05)		Define gross weight and gross mass (and the units involved), disc and blade loading.			X	X	X			
082 04 00 00		**MAIN-ROTOR AERODYNAMICS**								
082 04 01 00		**Hover flight outside ground effect**								
082 04 01 01		***Airflow through the rotor disc and around the blades***								
(01)	X	Based on Newton's second law (momentum), explain that the upward vertical force from the disc, i.e. the rotor thrust, is the result of vertical downward velocities inside the rotor disc.			X	X	X			
(02)		Explain why the production of the induced flow requires power applied to the shaft, i.e. induced power. Induced power is least			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		if the induced velocities have the same value on the whole disc (i.e. there is uniformity of flow over the disc).								
(03)		Explain why vertical rotor thrust must be higher than the weight of the helicopter because of the vertical drag on the fuselage.			X	X	X			
(04)		Define the pitch angle and the α of a blade element.			X	X	X			
(05)		Explain L and D relating to a blade element (including induced and profile drag).			X	X	X			
(06)		Explain the necessity for collective pitch angle changes, the influence on the α and rotor thrust, and the need for blade feathering.			X	X	X			
(07)		Describe the different blade shapes (as viewed from above).			X	X	X			
(08)		Explain how profile drag on the blade elements generates a torque on the main shaft, and define the resulting rotor profile power.			X	X	X			
(09)		Explain the influence of air density on the required powers.			X	X	X			
082 04 01 02		***Anti-torque force and tail rotor***								
(01)		Using Newton's third law (motion), explain the need for tail-rotor thrust, the required value being proportional to main-rotor torque. Show that tail-rotor power is proportional to tail-rotor thrust.			X	X	X			
(02)		Explain the necessity for feathering of the tail-rotor blades and their control by the yaw pedals, and the maximum and			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		minimum values of the pitch angles of the blades.								
082 04 01 03		***Total power required and hover outside ground effect (HOGE)***								
(01)		Define ancillary equipment and its power requirement.			X	X	X			
(02)		Define the total power required.			X	X	X			
(03)	X	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 (α)***								
(01)	X	Describe the dependence of the vertical climb speed on the opposite vertical air velocity relative to the rotor disk.			X	X	X			
(02)		Explain how α is controlled by the collective pitch angle control			X	X	X			
082 04 02 02		***Power and vertical speed***								
(01)		Define total main-rotor power as the sum of parasite power, induced power, climb power, and rotor profile power.			X	X	X			
(02)		Explain why the total main-rotor power required increases when the rate of climb increases.			X	X	X			
082 04 03 00		**Forward flight**								
082 04 03 01		***Airflow and forces in uniform inflow distribution***								
(01)		Explain the assumption of a uniform inflow distribution on the rotor disc.			X	X	X			
(02)		Show the upstream air velocities relative to the blade elements and the different effects on the advancing and retreating blades. Define the area of reverse flow.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		Explain the influence of forward speed on the circumferential speed of the blade tip.								
(03)		Assuming constant pitch angles and rigid blade attachments, explain the roll moment from the asymmetric distribution of L.			X	X	X			
(04)		Show that through cyclic feathering this imbalance could be eliminated by a low α (accomplished by a low pitch angle) on the advancing blade, and a high α (accomplished by a high pitch angle) on the retreating blade.			X	X	X			
(05)		Describe the high air velocity at the advancing blade tip and the compressibility effects which limit maximum speed.			X	X	X			
(06)		Describe the low air velocity on the retreating blade tip resulting from the difference between the circumferential speed and forward speed, the need for high α, and the onset of stall.			X	X	X			
(07)		Define the blade tip speed ratio.			X	X	X			
(08)		Explain the total rotor thrust that is perpendicular to the rotor disc and the need for tilting the thrust vector forward.			X	X	X			
(09)		Explain the conditions of equilibrium in steady straight and level flight.			X	X	X			
082 04 03 02		***The flare (powered flight)***								
(01)		Explain the flare in powered flight, the rearward tilt of the rotor disc and the thrust vector. Show the horizontal thrust component that is in the opposite direction to forward velocity.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		State the increase in thrust due to the upward inflow, and show the modifications in the α.			X	X	X			
(03)		Explain the increase in rotor rpm for a non-governed rotor.			X	X	X			
082 04 03 03		***Non-uniform inflow distribution in relation to inflow roll***								
(01)		Describe the inflow distribution which modifies α and L especially on the advancing and retreating blades.			X	X	X			
082 04 03 04		***Power and maximum speed***								
(01)		Explain that the induced velocities and power values decrease as the speed of the helicopter increases.			X	X	X			
(02)		Define profile drag and profile power, and the increase in their values with the speed of the helicopter.			X	X	X			
(03)		Define parasite drag and parasite power, and the increase in their values with the speed of the helicopter.			X	X	X			
(04)		Define total drag and its increase with the speed of the helicopter.			X	X	X			
(05)		Describe the power required for the tail rotor and the power required by ancillary equipment.			X	X	X			
(06)		Define the total power requirement as a sum of the above partial powers, and explain how it varies with the speed of the helicopter.			X	X	X			
(07)		Explain the influence of helicopter mass, air density, and additional external equipment on the partial powers and the total power required.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(08)		Describe translational lift and show the decrease in required total power as the helicopter increases its speed from the hover.			X	X	X			
082 04 04 00		**Hover and forward flight in ground effect**								
082 04 04 01		***Airflow in ground effect, downwash***								
(01)		Explain how the vicinity of the ground changes the downward flow pattern and the consequences on lift (thrust) at constant rotor power. Show that ground effect depends on the height of the rotor above the ground and the rotor diameter. Show the required rotor power at constant all-up mass (AUM) as a function of height above the ground. Describe the influence of forward speed.			X	X	X			
082 04 05 00		**Vertical descent**								
082 04 05 01		***Vertical descent, power on***								
(01)		Describe the airflow around the rotor disc in a trouble-free vertical descent, power on, the airflow opposing the helicopter's velocity, the relative airflow, and α.			X	X	X			
(02)		Explain the vortex-ring state, also known as settling with power. State the approximate vertical descent speeds that allow the formation of vortex ring, related to the values of the induced velocities.			X	X	X			
(03)		Describe the airflow relative to the blades, the root stall, the loss of lift at the blade tip, and the turbulence. Show the effect of raising the lever and describe the effects on the controls.			X	X	X			
082 04 05 02		***Autorotation***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the need for early recognition and for a quick initiation of recovery. Describe the recovery actions.			X	X	X			
(02)		Explain that the collective lever must be lowered quickly enough to avoid a rapid decay of rotor rpm due to drag on the blades, and explain the influence of rotational inertia of the rotor on the rate of decay.			X	X	X			
(03)		Show the induced flow through the rotor disc, the rotational velocity and relative airflow, the inflow and inflow angles.			X	X	X			
(04)		Show how the aerodynamic forces on the blade elements vary from root to tip and distinguish three zones: the inner stalled region, the middle driving region, and the driven region.			X	X	X			
(05)		Explain the control of the rotor rpm with collective pitch.			X	X	X			
(06)		Show the need for negative tail-rotor thrust with yaw control.			X	X	X			
(07)		Explain the final increase in rotor thrust caused by raising the collective pitch 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***								
(01)		Explain the factors that affect inflow angle and α, the autorotative power distribution, and the dissymmetry over the rotor disc in forward flight.			X	X	X			
082 04 06 02		***Flight and landing***								
(01)		Show the effect of forward speed on the vertical descent speed.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Explain the effects of gross weight, rotor rpm, and altitude (density) on endurance and range.			X	X	X			
(03)		Explain the manoeuvres for turning and touchdown.			X	X	X			
(04)		Explain the height–velocity 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		***Intentionally left blank***								
082 05 01 02		***Centrifugal turning moment (CTM)***								
(01)		Describe the centrifugal forces on the mass elements of a blade with pitch applied and the components of those forces. Show how the forces generate a moment that tries to reduce the blade pitch angle.			X	X	X			
(02)		Explain the methods of counteracting CTM with hydraulics, bias springs, and balance masses.			X	X	X			
082 05 01 03		***Coning angle in the hover***								
(01)		Define the tip path plane and the coning angle.			X	X	X			
(02)		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 mass being negligible).			X	X	X			
(03)		Justify the lower limit of rotor rpm.			X	X	X			
(04)		Explain the effect of the mass of a 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***								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		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 a flapping hinge.			X	X	X			
(02)		Assume no cyclic pitch and describe the lift on the advancing and retreating blades.			X	X	X			
(03)		State the azimuthal phase lag (90° or less) between the input (applied pitch) and the output (flapping angle). Explain flapback (the rearward tilting of the tip path plane and total rotor thrust).			X	X	X			
082 05 02 02		***Cyclic pitch (feathering) in forward flight***								
(01)		Show that in order to assume and maintain forward flight, the total rotor thrust vector must obtain a forward component by tilting the tip path plane.			X	X	X			
(02)		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 total rotor thrust.			X	X	X			
(03)		Show the cone described by the blades and define the virtual axis of rotation. Define the plane of rotation.			X	X	X			
(04)		Define the reference system in which the movements are defined: the shaft axis and the hub plane.			X	X	X			
(05)		Describe the swash plates, the pitch links and horns. Explain how the collective lever moves the non-rotating swash plate up or down the shaft axis.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		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			
(07)		Explain the translational lift effect when the speed increases.			X	X	X			
(08)	X	Justify the increase of the tilt angle of the thrust vector and of the 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***								
(01)		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			
(02)		Describe the profile drag forces on the blade elements and the periodic variation of these forces.			X	X	X			
082 05 03 02		***Intentionally left blank***								
082 05 03 03		***Ground resonance***								
(01)		Explain the movement of the CG of the blades due to lead-lag movements in the multibladed rotor.			X	X	X			
(02)		Show the effect on the fuselage and the danger of resonance between this force and the fuselage and undercarriage when the gear touches the ground.			X	X	X			
082 05 04 00		**Rotor systems**								
082 05 04 01		***See-saw or teetering rotor***								
(01)		Explain that a teetering rotor is prone to mast bumping in low-G situations, and that it is difficult to counteract because there is			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		no lift force to provide sideways movement.								
082 05 04 02		***Intentionally left blank***								
082 05 04 03		***Hingeless rotor, bearingless rotor***								
(01)		Show the forces on the flapping hinges with a large offset (virtual hinge) and the resulting moments, and compare them with other rotor systems.			X	X	X			
082 05 05 00		**Blade sailing**								
082 05 05 01		***Blade sailing and causes***								
(01)		Define blade sailing, the influence of low rotor rpm and of a headwind.			X	X	X			
082 05 05 02		***Minimising the danger***								
(01)		Describe actions that minimise danger and the demonstrated wind envelope for engaging and disengaging rotors.			X	X	X			
082 05 05 03		***Droop stops***								
(01)		Explain the purpose of droop stops, and their retraction.			X	X	X			
082 05 06 00		**Vibrations due to main rotor**								
082 05 06 01		***Intentionally left blank***								
082 05 06 02		***Intentionally left blank***								
082 06 00 00		**TAIL ROTORS**								
082 06 01 00		***Conventional tail rotor***								
082 06 01 01		***Intentionally left blank***								
082 06 01 02		***Tail-rotor aerodynamics***								
(01)		Explain the airflow around the blades in the hover and in forward flight, and the effects of the tip speeds on noise production and compressibility.			X	X	X			
(02)		Explain the effect of wind on tail-rotor aerodynamics and thrust in the hover, and any problems.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(03)		Explain tail-rotor thrust and the control through pitch alterations (feathering).			X	X	X			
(04)		Explain tail-rotor flapback, and the effects of Delta 3.			X	X	X			
(05)		Describe the roll moment and drift as side effects of the tail rotor.			X	X	X			
(06)		Explain the effects of tail-rotor failure.			X	X	X			
(07)		Explain the loss of tail-rotor effectiveness (LTE), tail-rotor vortexring state, causes, crosswind, and yaw speed.			X	X	X			
		Strakes on the tail boom								
(01)		Describe the strake and explain its function.			X	X	X			
		EQUILIBRIUM, STABILITY AND CONTROL								
		Equilibrium and helicopter attitudes								
		Hover								
(01)		Explain why the vector sum of forces and moments must be zero in any acceleration-free situation.			X	X	X			
(02)		Indicate the forces and the moments about the lateral axis in a steady hover.			X	X	X			
(03)		Indicate the forces and the moments about the longitudinal axis in a steady hover.			X	X	X			
(04)		Deduce how the roll angle in a steady hover without wind results from the moments about the longitudinal axis.			X	X	X			
(05)		Explain how the cyclic is used to equalise moments about the lateral axis in a steady hover.			X	X	X			
(06)		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			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(07)		Explain the influence of density altitude on the equilibrium of forces and moments in a steady hover.			X	X	X			
082 07 01 02		***Forward flight***								
(01)		Explain why the vector sum of forces and of moments must be zero in unaccelerated flight.			X	X	X			
(02)		Indicate the forces and the moments about the lateral axis in steady straight and level flight.			X	X	X			
(03)		Explain the influence of AUM on the forces and moments about the lateral axis in forward flight.			X	X	X			
(04)		Explain the influence of the CG position on the forces and moments about the lateral axis in forward flight.			X	X	X			
(05)		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			
(06)		Explain how forward speed influences the fuselage attitude.			X	X	X			
(07)		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***								
(01)		Define static stability; give an example of static stability and of static instability.			X	X	X			
(02)		Explain the contribution of the main rotor to speed stability.			X	X	X			
(03)		Describe the influence of the horizontal stabiliser on static longitudinal stability.			X	X	X			
(04)		Explain the effect of hinge offset on static stability.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(05)		Describe the influence of the tail rotor on static directional stability.			X	X	X			
(06)		Describe the influence of the vertical stabiliser on static directional stability.			X	X	X			
(07)		Explain the influence of the main rotor on static roll stability.			X	X	X			
(08)		Describe the influence of the longitudinal position of the CG on static longitudinal stability.			X	X	X			
082 07 02 02		***Static stability in the hover***								
(01)		Describe the initial movements of a hovering helicopter after the occurrence of a horizontal gust.			X	X	X			
082 07 02 03		***Dynamic stability***								
(01)		Define dynamic stability; give an example of dynamic stability and of dynamic instability.			X	X	X			
(02)		Explain why static stability is a precondition for dynamic stability.			X	X	X			
082 07 02 04		***Longitudinal stability***								
(01)		Explain the individual contributions of α and speed stability together with the stabiliser and fuselage to dynamic longitudinal stability.			X	X	X			
082 07 02 05		***Roll stability and directional stability***								
(01)		Know that a large static roll stability together with a small directional stability may lead to a Dutch roll.			X	X	X			
082 07 03 00		**Control**								
082 07 03 01		***Manoeuvre stability***								
(01)		Explain how helicopter control can be limited because of available stick travel.			X	X	X			
(02)		Explain how the CG position influences the remaining stick travel.			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
082 07 03 02		***Control power***								
(01)		Explain the meaning of the control moment.			X	X	X			
(02)		Explain the importance of the CG position on the control moment.			X	X	X			
(03)		Explain the influence of hinge offset on controllability.			X	X	X			
082 07 03 03		***Static and dynamic rollover***								
(01)		Explain the mechanism which causes dynamic rollover.			X	X	X			
(02)		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***								
(01)		Show the power required for HOGE and HIGE, and the power available.			X	X	X			
(02)		Explain the effects of AUM, ambient temperature and pressure, density altitude, and moisture.			X	X	X			
(03)		Describe the rate of climb in a vertical flight.			X	X	X			
082 08 01 02		***Forward flight***								
(01)		Compare the power required and the power available as a function of speed in straight and level flight.			X	X	X			
(02)		Define the maximum speed limited by power and the value relative to VNE and VNO.			X	X	X			
(03)		Use the power graph to determine the speeds of maximum rate of climb and the maximum angle of climb.			X	X	X			
(04)		Use the power graph to define true airspeed (TAS) for maximum range and			X	X	X			

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		maximum endurance, and consider the case of piston engine and turbine engine. Explain the effects of tailwind or headwind on the speed for maximum range.								
(05)		Explain the effects of AUM, pressure and temperature, density altitude, and humidity.			X	X	X			
082 08 01 03		***Manoeuvring***								
(01)		Define the load factor, the radius, and the rate of turn.			X	X	X			
(02)		Explain the relationship between the angle of bank, the airspeed and the radius of turn, and between the angle of bank and the load factor.			X	X	X			
(03)		Explain the influence of AUM, pressure and temperature, density altitude, and humidity.			X	X	X			
082 08 02 00		**Special conditions**								
082 08 02 01		***Operating with limited power***								
(01)		Explain operations with limited power, use the power graph to show the limitations on vertical and level flight, and describe power checks and procedures for take-off and landing.			X	X	X			
(02)		Describe manoeuvres with limited power.								
082 08 02 02		***Overpitch, overtorque***								
(01)		Describe overpitching and show the consequences.			X	X	X			
(02)		Describe situations likely to lead to overpitching.			X	X	X			
(03)		Describe overtorquing and show the consequences.			X	X	X			
(04)		Describe situations likely to lead to overtorquing.			X	X	X			

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SUBJECT 090 – COMMUNICATIONS

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
090 00 00 00		**COMMUNICATIONS**								
090 01 00 00		**CONCEPTS**								
090 01 01 00		**Associated terms**								
090 01 01 01		**Meanings and significance**								
(01)		Define commonly used air traffic services (ATS) terms for stations.	X	X	X	X	X	X	X	
(02)		Define commonly used ATS terms for communication methods.	X	X	X	X	X	X	X	
(03)		Recognise the terms used in conjunction with the approach and holding procedures.	X	X	X	X	X	X	X	
090 01 01 02		**Air traffic services (ATS) abbreviations**								
(01)		Define commonly used ATS abbreviations: — flight conditions; — airspace; — services; — time; — VFR-related terms; — IFR-related terms; — miscellaneous.	X	X	X	X	X	X	X	
090 01 01 03		**Q-code groups commonly used in radiotelephony (RT) air-ground communications**								
(01)		Define Q-code groups commonly used in RT air-ground communications: — pressure settings; — directions and bearings.	X	X	X	X	X	X	X	
(02)		State the procedure for obtaining bearing information in flight.	X	X	X	X	X	X	X	
090 01 01 04		**Categories of messages**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		Identify to which category of messages a type of message belongs and identify the associated priority indicator.	X	X	X	X	X	X	X	
090 02 00 00		**GENERAL OPERATING PROCEDURES**								
090 02 01 00		**Transmission standards**								
090 02 01 01		**Transmission of letters**								
(01)		Know the phonetic alphabet used in RT.	X	X	X	X	X	X	X	
(02)		Identify the circumstances when words should be spelt out.	X	X	X	X	X	X	X	
090 02 01 02		**Transmission of numbers**								
(01)		Describe the method of transmission of numbers: — pronunciation; — single digits, whole hundreds and whole thousands; — state how numbers are transmitted in different circumstances.	X	X	X	X	X	X	X	
090 02 01 03		**Transmission of time**								
(01)		Describe the ways of transmitting time: — the standard time reference is the Coordinated Universal Time (UTC); — using only minutes, or minutes and hours, when required.	X	X	X	X	X	X	X	
(02)		Describe the different ways in which time is to be transmitted.	X	X	X	X	X	X	X	
090 02 01 04		**Transmission techniques**								
(01)	X	Explain the techniques used for making good RT transmissions.	X	X	X	X	X	X	X	
090 02 01 05		**Standard words and phrases**								
(01)		Define the meaning of standard words and phrases.	X	X	X	X	X	X	X	
(02)		Recognise, describe and use the correct standard phraseology for each phase of a	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		VFR flight (consider communication with each type of aeronautical station): — before taxi; — taxi; — departure; — en route; — circuit; — final; — landing; — after landing.								
(03)		Recognise, describe and use the correct standard phraseology for each phase of an IFR flight, including PBN operations (consider communication with each type of aeronautical station): — before pushback or taxi; — pushback; — taxi; — departure; — en route; — approach; — final approach; — landing; — after landing.	X	X	X	X	X	X	X	
(04)		Explain phraseology for the selective calling system (SELCAL) and aircraft communications addressing and reporting system (ACARS).	X	X	X	X	X	X	X	
(05)		Explain traffic alert and collision avoidance system (TCAS) phraseology.	X	X	X	X	X	X	X	
090 02 01 06		**RT call signs for aeronautical stations including use of abbreviated call signs**								
(01)		Name the two parts of the call sign of an aeronautical station.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Identify the call-sign suffixes for aeronautical stations.	X	X	X	X	X	X	X	
(03)		Explain when the call sign may be omitted or abbreviated to the use of suffix only.	X	X	X	X	X	X	X	
090 02 01 07		**RT call signs for aircraft including use of abbreviated call signs**								
(01)		Describe the three different ways to compose an aircraft call sign.	X	X	X	X	X	X	X	
(02)		Describe the abbreviated forms for aircraft call signs.	X	X	X	X	X	X	X	
(03)		Explain when aircraft call signs may be abbreviated.	X	X	X	X	X	X	X	
(04)		Explain when the suffix 'HEAVY' or 'SUPER' is used with an aircraft call sign.	X	X	X	X	X	X	X	
(05)		Explain the use of the phrase 'Change your call sign to…'.	X	X	X	X	X	X	X	
(06)		Explain the use of the phrase 'Revert to flight plan call sign'.	X	X	X	X	X	X	X	
090 02 01 08		**Transfer of communication**								
(01)		Describe the procedure for transfer of communication: — by ground station; — by aircraft.	X	X	X	X	X	X	X	
090 02 01 09		**Test procedures including readability scale**								
(01)		Explain how to test radio transmission and reception.	X	X	X	X	X	X	X	
(02)		State the readability scale and explain its meaning.	X	X	X	X	X	X	X	
090 02 01 10		**Read-back and acknowledgement requirements**								
(01)		Describe the requirement to read back ATC route clearances.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(02)		Describe the requirement to read back clearances related to the runway in use.	X	X	X	X	X	X	X	
(03)		Describe the requirement to read back other clearances including conditional clearances.	X	X	X	X	X	X	X	
(04)		Describe the requirement to read back other data such as runway, secondary surveillance radar (SSR) codes, etc.	X	X	X	X	X	X	X	
090 02 01 11		**Radar procedural phraseology**								
(01)		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	X	X	
090 02 01 12		**Level changes and reports**								
(01)		Use the correct term to describe vertical position in relation to: — flight level (standard pressure setting); — altitude (metres/feet on QNH); — height (metres/feet on QFE).	X	X	X	X	X	X	X	
090 02 01 13		**Data link messages**								
(01)		List the different types of messages of the controller–pilot data link communications (CPDLC) function and give examples of data link messages.	X	X	X	X	X	X	X	
(02)		Describe a notification phase (LOG ON) and state its purpose.	X	X	X	X	X	X	X	
(03)		Explain the phrases to be used: — when voice communication is used to correct a CPDLC message; — in case of single CPDLC message failure; — when CPDLC has failed;	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
		— when reverting from CPDLC to voice communication.								
090 03 00 00		**RELEVANT WEATHER INFORMATION**								
090 03 01 00		**Aerodrome weather**								
090 03 01 01		**Aerodrome weather terms**								
(01)		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 definition of cloud and visibility OK (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	X	X	
090 03 01 02		**Weather broadcast**								
(01)		List the sources (VOLMET and ATIS units) of weather information available for aircraft in flight, and describe situation(s) in which a pilot would normally obtain each.	X	X	X	X	X	X	X	
(02)	X	Explain the meaning of the acronyms ‘D-ATIS’, ‘ATIS’, and ‘VOLMET’.	X	X	X	X	X	X	X	
(03)		Explain and demonstrate how to decode ATIS messages.	X	X	X	X	X	X	X	
090 04 00 00		**VOICE COMMUNICATION FAILURE**								
090 04 01 00		**Required action**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
090 04 01 01		**Action required to be taken in case of communication failure**								
(01)		State the action to be taken in case of communication failure on a controlled VFR flight.	X	X	X	X	X	X	X	
(02)		Identify the frequencies to be used in an attempt to establish communication.	X	X	X	X	X	X	X	
(03)		State the additional information that should be transmitted in the event of receiver failure.	X	X	X	X	X	X	X	
(04)		Identify the SSR code that may be used to indicate communication failure.	X	X	X	X	X	X	X	
(05)		Explain the action to be taken by a pilot that experiences a communication failure in the aerodrome traffic pattern at controlled aerodromes.	X	X	X	X	X	X	X	
(06)		Describe the action to be taken in case of communication failure on an IFR flight.	X	X	X	X	X	X	X	
(07)		Describe the action to be taken in case of communication failure on an IFR flight when flying in visual meteorological conditions (VMC) and the flight will be terminated in VMC.	X	X	X	X	X	X	X	
(08)		Describe the action to be taken in case of communication failure on an IFR flight when flying in instrument meteorological conditions (IMC).	X	X	X	X	X	X	X	
(09)		Explain the causes and possible safety impacts of a blocked frequency.	X	X	X	X	X	X	X	
090 05 00 00		**DISTRESS AND URGENCY PROCEDURES**								
090 05 01 00		**Signals and procedures**								
090 05 01 01		**Distress**								

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(01)		State the DISTRESS signal(s) and DISTRESS procedure(s).	X	X	X	X	X	X	X	
(02)		Define 'DISTRESS'.	X	X	X	X	X	X	X	
(03)		Identify the frequencies that should be used by aircraft in DISTRESS.	X	X	X	X	X	X	X	
(04)		Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	X	X	X	X	X	X	X	
(05)		Describe the action to be taken by the station which receives a DISTRESS message.	X	X	X	X	X	X	X	
(06)		Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	X	X	X	X	X	X	X	
(07)		List the correctly sequenced elements of a DISTRESS signal/message and describe the message content.	X	X	X	X	X	X	X	
(08)		Describe the use of discrete frequencies (DEF) in case of distress or urgency.	X	X	X	X	X	X	X	
(09)		Explain the causes and possible safety impacts of a blocked frequency.	X	X	X	X	X	X	X	
090 05 01 02		**Urgency**								
(01)		State the URGENCY signal(s) and URGENCY procedure(s).	X	X	X	X	X	X	X	
(02)		Define 'URGENCY'.	X	X	X	X	X	X	X	
(03)		Identify the frequencies that should be used by aircraft in URGENCY.	X	X	X	X	X	X	X	
(04)		Describe the action to be taken by the station which receives an URGENCY message.	X	X	X	X	X	X	X	
(05)		Describe the action to be taken by all other stations when an URGENCY procedure is in progress.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
(06)		List the correctly sequenced elements of an URGENCY signal/message and describe the message content.	X	X	X	X	X	X	X	
(07)		State that URGENCY messages take priority over all other messages except DISTRESS.	X	X	X	X	X	X	X	
090 06 00 00		**VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**								
090 06 01 00		**General principles**								
090 06 01 01		**Spectrum, bands, range**								
(01)		Describe the radio-frequency spectrum with particular reference to VHF.	X	X	X	X	X	X	X	
(02)		Describe the radio-frequency spectrum of the bands into which the radio-frequency spectrum is divided.	X	X	X	X	X	X	X	
(03)		Identify the frequency range of the VHF band.	X	X	X	X	X	X	X	
(04)		State the band normally used for aeronautical mobile service (AMS) voice communication.	X	X	X	X	X	X	X	
(05)		State the frequency separation allocated between consecutive VHF frequencies.	X	X	X	X	X	X	X	
(06)		List the factors which reduce the effective range and quality of VHF radio transmissions.	X	X	X	X	X	X	X	
090 07 00 00		**Other communications**								
090 07 01 00		**Weather observations, Morse code**								
090 07 01 01		**Meteorological observations**								
(01)		Explain when aircraft routine meteorological observations should be made.	X	X	X	X	X	X	X	
(02)		Explain when aircraft special meteorological observations should be made.	X	X	X	X	X	X	X	

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter			IR	CB-IR(A) and EIR	Remarks
			ATPL	CPL	ATPL/IR	ATPL	CPL			
090 07 01 02		**Use of Morse code**								
(01)	X	Describe and list Morse code.	X	X	X	X	X	X	X	
(02)		Find the Morse code identifiers of radio navigation aids (VHF omnidirectional radio range (VOR), distance-measuring equipment (DME), non-directional radio beacon (NDB), instrument landing system (ILS)) using aeronautical charts.	X	X	X	X	X	X	X	

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SUBJECT AREA 100 – KNOWLEDGE, SKILLS AND ATTITUDES (KSA)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter		
			ATPL	CPL	ATPL/IR	ATPL	CPL
100 00 00 00		**KNOWLEDGE, SKILLS AND ATTITUDES (KSA)**					
100 01 00 00		**ICAO CORE COMPETENCIES**					
(01)		Recognise the ICAO Core Competencies listed below and the associated competency descriptions (ICAO Doc 9995 'Manual of Evidence-based Training'): — Application of Procedures; — Communication; — Aircraft Flight Path Management, automation; — Aircraft Flight Path Management, manual control; — Leadership and Teamwork; — Problem Solving and Decision Making; — Situation Awareness; — Workload Management.	X	X	X	X	X
100 02 00 00		**CORE COMPETENCIES LEARNING OBJECTIVES**					
100 02 01 00		**Communication**					
(01)		Show the ability to identify whether the recipient is ready and able to receive the information.	X	X	X	X	X
(02)		Show the ability to appropriately select what, when, how and with whom to communicate.	X	X	X	X	X
(03)		Show the ability to communicate clearly, accurately and concisely.	X	X	X	X	X
(04)		Show the ability to confirm whether the recipient correctly understands important information.	X	X	X	X	X
(05)		Show the ability to listen actively and show you understand the information you receive.	X	X	X	X	X
(06)		Show the ability to ask relevant and effective questions.	X	X	X	X	X
(07)		Show the ability to adhere to standard radio-telephony phraseology.	X	X	X	X	X
(08)		Show the ability to accurately read, interpret, construct and respond to given documentation in English.	X	X	X	X	X
(09)		Show the ability to correctly interpret non-verbal communication.	X	X	X	X	X
(10)		Show the ability to use appropriate eye contact, body movement and gestures that are consistent with and support verbal messages.	X	X	X	X	X
100 02 02 00		**Leadership and teamwork**					

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter		
			ATPL	CPL	ATPL/IR	ATPL	CPL
(01)		Show the ability to create an atmosphere of open communication that encourages participation.	X	X	X	X	X
(02)		Show the initiative and the ability to give directions when required.	X	X	X	X	X
(03)		Show the ability to admit mistakes and take responsibility.	X	X	X	X	X
(04)		Show the ability to anticipate and respond appropriately to others' needs.	X	X	X	X	X
(05)		Show the ability to carry out instructions when directed.	X	X	X	X	X
(06)		Show the ability to communicate relevant concerns and intentions.	X	X	X	X	X
(07)		Show the ability to give and receive feedback constructively.	X	X	X	X	X
(08)		Show empathy, respect and tolerance for others.	X	X	X	X	X
(09)		Show the ability to engage others in planning and to allocate activities fairly and appropriately according to others' abilities.	X	X	X	X	X
(10)		Show the ability to address and resolve conflicts and disagreement in a constructive manner.	X	X	X	X	X
(11)		Show the ability to project self-control.	X	X	X	X	X
100 02 03 00		**Problem-solving and decision-making**					
(01)		Show the ability to seek accurate and adequate information from appropriate sources.	X	X	X	X	X
(02)		Show the ability to identify and verify what and why things have gone wrong.	X	X	X	X	X
(03)		Show the ability to employ proper problem-solving strategies.	X	X	X	X	X
(04)		Show the ability to persevere in working through problems.	X	X	X	X	X
(05)		Show the ability to use appropriate and timely decision-making processes.	X	X	X	X	X
(06)		Show the ability to set priorities appropriately.	X	X	X	X	X
(07)		Show the ability to identify and consider options effectively.	X	X	X	X	X
(08)		Show the ability to monitor, review and adapt decisions as required.	X	X	X	X	X
(09)		Show the ability to identify and manage risks.					
100 02 04 00		**Situation awareness**					
(01)		Demonstrate the ability to identify and assess accurately the general environment as it may affect the operation.	X	X	X	X	X
(02)		Demonstrate the ability to identify threats, errors and undesirable aircraft states.	X	X	X	X	X
(03)		Demonstrate the ability to manage threats, errors and undesirable aircraft states.	X	X	X	X	X
100 02 05 00		**Workload management**					
(01)		Show the ability to maintain self-control.	X	X	X	X	X
(02)		Show the ability to plan, prioritise and schedule tasks effectively.	X	X	X	X	X

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter		
			ATPL	CPL	ATPL/IR	ATPL	CPL
(03)		Show the ability to manage time effectively when carrying out tasks.	X	X	X	X	X
(04)		Show the ability to offer and accept assistance, delegate when necessary and ask for help early.	X	X	X	X	X
(05)		Show the ability to manage interruptions, distractions, variations and failures effectively.	X	X	X	X	X
100 03 00 00		**ADDITIONAL THREAT AND ERROR MANAGEMENT (TEM) RELATED LEARNING OBJECTIVES**					
100 03 01 00		**Application of knowledge**					
(01)		Demonstrate the ability to complete pre-flight planning in practical exercises.	X	X	X	X	X
(02)		Demonstrate the KSA and TEM relating to phases of flight in the ground training environment.	X	X	X	X	X
100 03 02 00		**Upset prevention and recovery training (UPRT) and resilience**					
		Note: Resilience is defined as 'the ability to recognise, absorb and adapt to disruptions'. It is supported by the pilot's core competencies and improved by experience, which can be gained by training for unexpected events or situations.					
(01)		Recognise potential upset 'threats' and suggest effective 'threat management' in scenario situations.	X	X			
(02)		Recognise potential upset 'errors' and suggest effective 'error management' in scenario situations.	X	X			
(03)		Explain the causes of and contributing factors to upsets.	X	X			
(04)		Demonstrate resilience during scenario and/or other exercises.	X	X	X	X	X
(05)		Show the ability to identify the signs and discuss the effects of stress, fatigue and aviation lifestyle on situation awareness, and how to cope with them in order to maintain situation awareness.	X	X	X	X	X
100 04 00 00		**MENTAL MATHS**					
		Note: Demonstrate, in non-calculator test scenarios or scenario exercises, the ability in a time-efficient manner to make correct mental calculation approximations for the following.					
(01)		Convert between volumes and masses of fuel using range of units.	X	X	X	X	X
(02)		Estimate time, distance and speed.	X	X	X	X	X
(03)		Estimate the rate of climb or rate of descent, distance and time.	X	X			
(04)		Add or subtract time, distance, and fuel mass.	X	X	X	X	X
(05)		Calculate fuel burn given time and fuel flow.	X	X	X	X	X

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Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplanes		Helicopter		
			ATPL	CPL	ATPL/IR	ATPL	CPL
(06)		Calculate the time available (for decision-making) given relevant fuel information.	X	X	X	X	X
(07)		Determine the top of descent using a simple method that is described by the approved training organisation (ATO).	X	X			
(08)		Determine the values that vary by a percentage, e.g. dry-to-wet landing distance and fuel burn.	X	X	X	X	X
(09)		Estimate heights at distances on a 3-degree glideslope.	X	X	X	X	X
(10)		Estimate headings using the 1-in-60 rule.	X	X	X	X	X
(11)		Estimate headwind and crosswind components given wind speed and direction and runway in use.	X	X	X	X	X

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GM1 FCL.310; FCL.515(b); FCL.615(b) Theoretical knowledge examination

Explanation of the verbs used in The Benjamin Bloom Taxonomy

(a) The depth or level of learning to be achieved during the training and the corresponding level of attainment to be examined or assessed is based on the following taxonomy. In each case, the level of knowledge or skill is signified by the learning objective (LO) verb.

(b) The majority of the Los relate to the cognitive domain. The taxonomy described by B. Bloom (1956) and Anderson & Krathwohi (2001) has been used as the standard.

(c) The six sequential increasing levels of required cognitive learning are identified by the LO verb. Hence the lowest level 'remember' is signified by verbs such as 'state', 'list', 'define' and 'recall' whilst the next higher level of 'understand' is signified by verbs such as 'describe' and 'explain'. The third level of 'apply' is signified by the verbs 'calculate', 'interpret', 'relate' and 'solve'. However, the higher levels of 'analyse', which would be signified by the verbs 'plan' or 'discuss' and 'evaluate' and 'create' are less common due at least partially to questions presently possible in the ECQB examination.

(d) The LOs used in Area 100 KSA differ in that they require a combination of knowledge and skills. However, the 'skill' level does not relate to Bloom's psychomotor taxonomy but is more closely aligned to their taxonomy levels required in medicine, because knowledge and skills must be combined by the student pilot in a strategy.

(e) The verbs 'demonstrate' and 'show', with their meanings defined below, have therefore been used to supplement the cognitive LO verbs for the Area 100 KSA LOs.

(1) 'Demonstrate' means the selection and use of the appropriate knowledge, skills and attitudes within a strategy to achieve an effective outcome. It signifies a high taxonomy level and would normally be assessed using multiple indicators from more than one core competency.

(2) 'Show' means the attainment of knowledge, skill or attitude. It signifies a lower taxonomy level than 'demonstrate' and would normally be assessed by a single indicator.

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Subpart F - Airline Transport Pilot Licence – ATPL

SECTION 1 – COMMON REQUIREMENT

AMC1 FCL.310; FCL.515(b); FCL.615(b) Theoretical knowledge examinations

LEARNING OBJECTIVES FOR ATPL, CPL, IR, CB-IR(A) and EIR

(a) Aeroplanes and helicopters

GENERAL

In the tables of this AMC, the applicable LOs for each licence or rating are marked with an 'X'.

The LOs define the subject knowledge and applied knowledge, skills and attitudes that a student pilot should have assimilated during the theoretical knowledge course.

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).

ATOs are required to produce a training plan for each of their courses based on the instructional systems design (ISD) methodology as specified in AMC2 ORA.ATO.230.

Additional guidance on the meaning and taxonomy of the verbs used in the LOs can be found in GM1 FCL.310, FCL.515(b), and FCL.615(b).

TRAINING AIMS

After completion of the training, a student pilot should:

— be able to understand and apply the subject knowledge in order to be able to identify and manage threats and errors effectively;

— meet at least the Area 100 KSA minimum standard.

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 applicable legislation and standards:

Reference	Legislation/Standard
The Basic Regulation	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018
The Aircrew Regulation	Commission Regulation (EU) No 1178/2011 of 3 November 2011 (as amended)

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Reference	Legislation/Standard
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 General Student Pilot Route Manual (GSPRM) contains planning data plus aerodrome and approach charts that may be used in theoretical knowledge training courses. The guidelines on its content can be found in this AMC, in front of the LO table for Subject 033 ‘Flight planning and monitoring’.

Excerpts from any aircraft manuals including but not limited to CAP 696, 697 and 698 for aeroplanes, and CAP 758 for helicopters may be used in training. Where questions refer to excerpts from aircraft manuals, the associated aircraft data will be provided in the examinations.

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.

Note: In all subject areas, the term ‘mass’ is used to describe a quantity of matter, and ‘weight’ when describing the force. However, the term ‘weight’ is normally used in aviation to colloquially describe mass. The pilot should always note the units to determine whether the term ‘weight’ is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).’

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DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LOs FOR ATPL, CPL, IR, CB-IR(A) and EIR

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, IR, CB-IR(A) and EIR.

For each topic in the detailed theoretical knowledge syllabus, one or more LOs are set out in the appendices as shown below:

— Appendix 010 AIR LAW

— Appendix 021 AIRCRAFT GENERAL KNOWLEDGE – AIRFRAME, SYSTEMS AND POWER PLANT

— Appendix 022 AIRCRAFT GENERAL KNOWLEDGE – INSTRUMENTATION

— Appendix 031 FLIGHT PERFORMANCE AND PLANNING – MASS AND BALANCE

— Appendix 032 FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – AEROPLANES

— Appendix 033 FLIGHT PERFORMANCE AND PLANNING – FLIGHT PLANNING AND MONITORING

— Appendix 034 FLIGHT PERFORMANCE AND PLANNING – PERFORMANCE – HELICOPTERS

— Appendix 040 HUMAN PERFORMANCE AND LIMITATIONS

— Appendix 050 METEOROLOGY

— Appendix 061 NAVIGATION – GENERAL NAVIGATION

— Appendix 062 NAVIGATION – RADIO NAVIGATION

— Appendix 070 OPERATIONAL PROCEDURES

— Appendix 081 PRINCIPLES OF FLIGHT – AEROPLANES

— Appendix 082 PRINCIPLES OF FLIGHT – HELICOPTERS

— Appendix 090 COMMUNICATIONS

— Appendix AREA 100 KNOWLEGDE, SKILLS AND ATTITUDES (KSA)

(b) Airships - RESERVED

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CPL AND IR - RESERVED

— AIRSHIPS – RESERVED

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GM1 FCL.310; FCL.615(b); FCL.835(d) Theoretical knowledge examinations

EXPLANATION OF THE VERBS USED IN THE BENJAMIN BLOOM TAXONOMY

(a) The depth or level of learning to be achieved during the training and the corresponding level of attainment to be examined or assessed is based on the following taxonomy. In each case, the level of knowledge or skill is signified by the learning objective (LO) verb.

(b) The majority of the LOs relate to the cognitive domain. The taxonomy described by B. Bloom (1956) and Anderson & Krathwohl (2001) has been used as the standard.

(c) The six sequential increasing levels of required cognitive learning are identified by the LO verb. Hence the lowest level 'remember' is signified by verbs such as 'state', 'list', 'define' and 'recall' whilst the next higher level of 'understand' is signified by verbs such as 'describe' and 'explain'. The third level of 'apply' is signified by the verbs 'calculate', 'interpret', 'relate' and 'solve'. However, the higher levels of 'analyse', which would be signified by the verbs 'plan' or 'discuss' and 'evaluate' and 'create' are less common due at least partially to questions presently possible in the ECQB examination.

(d) The LOs used in Area 100 KSA differ in that they require a combination of knowledge and skills. However, the 'skill' level does not relate to Bloom's psychomotor taxonomy but is more closely aligned to the higher taxonomy levels required in medicine, because knowledge and skills must be combined by the student pilot in a strategy.

(e) The verbs 'demonstrate' and 'show', with their meanings defined below, have therefore been used to supplement the cognitive LO verbs for the Area 100 KSA LOs.

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SECTION 2 – SPECIFIC REQUIREMENTS FOR THE AEROPLANE CATEGORY – ATPL(A)

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.

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SECTION 3 – SPECIFIC REQUIREMENTS FOR THE HELICOPTER CATEGORY – ATPL(H)

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.

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Subpart G - Instrument Rating - IR

SECTION 1 – COMMON REQUIREMENTS

AMC1 FCL.310; FCL.515(b); FCL.615(b) Theoretical knowledge examinations

LEARNING OBJECTIVES FOR ATPL, CPL, IR, CB-IR(A) and EIR

(a) Aeroplanes and helicopters

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The LOs define the subject knowledge and applied knowledge, skills and attitudes that a student pilot should have assimilated during the theoretical knowledge course.

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DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LOs FOR ATPL, CPL, IR, CB-IR(A) and EIR

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— Appendix 050 METEOROLOGY

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— Appendix 070 OPERATIONAL PROCEDURES

— Appendix 081 PRINCIPLES OF FLIGHT – AEROPLANES

— Appendix 082 PRINCIPLES OF FLIGHT – HELICOPTERS

— Appendix 090 COMMUNICATIONS

— Appendix AREA 100 KNOWLEGDE, SKILLS AND ATTITUDES (KSA)

(b) Airships

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CPL AND IR

— AIRSHIPS

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GM1 FCL.310; FCL.615(b) Theoretical knowledge examinations

EXPLANATION OF THE VERBS USED IN THE BENJAMIN BLOOM TAXONOMY

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(b) The majority of the LOs relate to the cognitive domain. The taxonomy described by B. Bloom (1956) and Anderson & Krathwohl (2001) has been used as the standard.

(c) The six sequential increasing levels of required cognitive learning are identified by the LO verb. Hence the lowest level 'remember' is signified by verbs such as 'state', 'list', 'define' and 'recall' whilst the next higher level of 'understand' is signified by verbs such as 'describe' and 'explain'. The third level of 'apply' is signified by the verbs 'calculate', 'interpret', 'relate' and 'solve'. However, the higher levels of 'analyse', which would be signified by the verbs 'plan' or 'discuss' and 'evaluate' and 'create' are less common due at least partially to questions presently possible in the ECQB examination.

(d) The LOs used in Area 100 KSA differ in that they require a combination of knowledge and skills. However, the 'skill' level does not relate to Bloom's psychomotor taxonomy but is more closely aligned to the higher taxonomy levels required in medicine, because knowledge and skills must be combined by the student pilot in a strategy.

(e) The verbs 'demonstrate' and 'show', with their meanings defined below, have therefore been used to supplement the cognitive LO verbs for the Area 100 KSA LOs.

(1) 'Demonstrate' means the selection and use of the appropriate knowledge, skills and attitudes within a strategy to achieve an effective outcome. It signifies a high taxonomy level and would normally be assessed using multiple indicators from more than one core competency.

(2) 'Show' means the attainment of knowledge, skill or attitude. It signifies a lower taxonomy level than 'demonstrate' and would normally be assessed by a single indicator.'

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AMC1 FCL.615(b) IR Theoretical knowledge and flight instruction

Syllabus of theoretical knowledge for the IR following the competency-based modular course and BIR

(a) The syllabus for the theoretical knowledge instruction and examination for the ATPL, MPL, CPL and IR in AMC1 FCL.310; FCL.515(b); FCL.615(b), FCL.835(d) should be used for the CB-IR(A) and the BIR respectively.

(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 Section 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 BIR within the validity period of the examination. An applicant wishing to transfer to a competency-based IR(A) or BIR 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 BIR for those subjects or theory items already completed.

AMC1 FCL.625(c) IR – Validity, revalidation and renewal

RENEWAL OF INSTRUMENT RATING AT AN APPROVED TRAINING ORGANISATION (ATO): REFRESHER TRAINING

(a) The objective of the refresher training at an ATO is to reach the level of proficiency needed to pass the instrument rating proficiency check, as described in Appendix 9, or the instrument rating skill test as described in Appendix 7 to Part-FCL, as applicable. The amount of refresher training needed should be determined by the ATO on a case-by-case basis, taking into account the following factors:

(1) the experience of the applicant;

(2) the amount of time elapsed since the privileges of the rating were last used;

(3) the complexity of the aircraft;

(4) whether the applicant has a current rating on another aircraft type or class; and

(5) where considered necessary, the performance of the applicant during a simulated proficiency check for the rating in a flight simulation training device (FSTD) or an aircraft of a relevant type or class.

The amount of training needed to reach the desired level of competency should increase with the time elapsed since the privileges of the rating were last used.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme based on the ATO's approved course for the rating and focusing on those aspects where the applicant has shown the greatest needs. Theoretical-knowledge instruction should be included, as necessary. The performance of the applicant should be reviewed during the training, and additional instruction should be provided where necessary to reach the standard required for the proficiency check.

(c) After successful completion of the training, the ATO should provide a training completion certificate to the applicant, which describes the evaluation of the factors listed under (a) above and the training received, and includes a statement that the training has been successfully completed. The training completion certificate should be presented to the examiner prior to the proficiency check. Following the successful renewal of the rating,

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the training completion certificate and examiner report form should be submitted to the competent authority.

(d) Taking into account the factors listed in (a) above, an ATO may also decide that the applicant already possesses the required level of proficiency and that no refresher training is necessary. In such a case, the certificate or other documental evidence referred to in point (c) above should contain a respective statement including sufficient reasoning.

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Subpart H - Class and Type Ratings

SECTION 1 – COMMON REQUIREMENTS

AMC1 FCL.700 Circumstances in which class or type ratings are required

a) A class or type rating and licence endorsement should comply with the class and type ratings that are listed in one of the following EASA publications, as applicable:

(1) 'List of Aeroplanes – Class and Type Ratings and Endorsement List'; and
(2) 'List of Helicopters – Type Ratings List'.

b) Holders of Part-FCL licences should complete differences training or familiarisation training in accordance with the lists of point (a).

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 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) Additional class and type rating lists and endorsement lists are published by the European Aviation Safety Agency (EASA) and will be used by the Brunei DCA when processing aircrew licences.

(c) 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.

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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.

AMC1 FCL.725(a) Requirements for the issue of class and type rating

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;

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(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.

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(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, auto flight 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; and

(J) weather radar system, best practices for optimum use, interpretation of displayed information.

(11) cockpit, cabin and cargo compartment:

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(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};

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(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;

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(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, $V1_{red}$, 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;

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(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 the 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;

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(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.

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(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:

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(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.

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(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, including radio;

(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) HUMSS;

(J) Weather radar system, best practices for optimum use, interpretation of displayed information.

(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;

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(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.

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(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):

(6) 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.

(7) procedures and limitations:

(i) operational procedures;

(ii) crew co-ordination.

(g) Special requirements for helicopters with EFIS.

(h) Optional equipment.

III. Airships - RESERVED

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 availability 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.

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(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

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(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.

GM1 FCL.725(e) Requirements for the issue of class and type ratings

The hours gained during the instruction flights for category 1 or 2 flight tests are not considered as flight tests related to development, certification or production.

AMC1 FCL.740(b) Validity and renewal of class and type ratings

Renewal of class and type ratings: refresher training at an ATO or with an instructor

(a) 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 or the instructor, as applicable, taking into account the following factors:

(1) the experience of the applicant;

(2) the amount of time elapsed since the privileges of the rating were last used;

(3) the complexity of the aircraft;

(4) whether the applicant has a current rating on another aircraft type or class;

(5) where considered necessary, the performance of the applicant during a simulated proficiency, check for the rating in an FSTD or an aircraft of the relevant type or class.

It should be expected that the amount of training needed to reach the desired level of proficiency will increase analogously to the time elapsed since the privileges of the rating were last used.

(b) After having determined the needs of an applicant, the ATO or the instructor, as applicable, should develop an individual training programme based on the initial training for the rating, focusing on the aspects where the applicant has shown the greatest needs.

(c) With the exception of refresher training for ratings for aircraft referred to in point FCL.740(b)(2)(i), refresher training should include theoretical knowledge instruction, as necessary, such as for type-specific system failures in complex aircraft. The performance of the applicant should be reviewed during the training and additional instruction should be provided to the applicant, where necessary, to reach the standard required for the proficiency check.

(d) After successful completion of the training, the ATO, the DTO or the instructor, as applicable, should issue the applicant with a training completion certificate or another document specified by the competent authority, describing the evaluation of the factors listed in (a), the training received, and a statement that the training has been successfully completed. The training completion certificate should be presented to the examiner prior to the proficiency check. Following the successful renewal of the rating, the training completion certificate or the other document specified by the competent authority and the examiner report form should be submitted to the competent authority.

(e) Taking into account the factors listed in (a) above, the ATO or the instructor, as applicable, may also decide that the applicant already possesses the required level of proficiency and that no refresher training is necessary. In such a case, the certificate or other documental evidence referred to in (c) above should contain a respective statement including sufficient reasoning.

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GM1 FCL.740(b) Validity and renewal of class and type ratings

RENEWAL OF CLASS AND TYPE RATINGS: REFRESHER TRAINING AT AN AOC HOLDER

It is recommended that an AOC holder approved for renewal of type ratings under Part-ORO may provide refresher training if the applicant is enrolled in the EBT programme; and if the rating has lapsed by no more than 1 year.

If the rating has lapsed by more than 1 year, it is recommended that the applicant consider to follow the training at an ATO and AMC1 FCL.740(b) applies.

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SECTION 2 – SPECIFIC REQUIREMENTS FOR THE AEROPLANE CATEGORY

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 single pilot (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 operations:

Subject ref.:	Syllabus content:
021 00 00 00	AIRCRAFT GENERAL KNOWLEGDE: AIRFRAME, SYSTEMS, AND POWER PLANT
021 09 01 03 021 09 03 00 021 09 03 02 021 09 03 03 021 09 04 00 021 09 04 01 021 09 04 03 021 09 04 04	Alternating current Generation AC generation Constant speed drive (CSD) and integrated drive generator (IDG) systems Distribution General AC distribution Electrical load management and monitoring systems: automatic generators and bus switching during normal and failure operation, indications and warnings
021 06 01 01	Piston-engine air supply
021 06 01 02	Gas turbine engine: bleed-air supply
021 10 10 01 021 11 03 01 021 10 04 01 021 03 01 09	Performance Engine fuel system Carburettor: design, operation, degraded modes of operation, indications and warnings Mixture
021 11 00 00 to 021 11 01 04	Turbine engines
021 13 00 00	Oxygen systems
032 03 00 00	**Performance class B: ME aeroplanes**
032 03 03 01 032 03 03 02 032 03 03 04 032 01 03 00 032 01 04 00	Take-off Climb Landing Level flight, range and endurance Climbing

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Subject ref.:	Syllabus content:
032 01 05 00 032 02 04 00	Descending Climb, cruise and descent
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 00 050 02 05 00	Jet streams Standing waves
050 09 01 00 to 050 09 04 05	Flight hazards Icing and turbulence Thunderstorms
062 03 00 00	**Basic radar principles**
062 03 00 01 to 062 03 04 00	Basic radar principles Airborne radar SSR
081 00 00 00	**PRINCIPLES OF FLIGHT: AEROPLANES**
081 02 01 00 081 02 02 00 081 02 03 00	Speeds Shock waves Effects of exceeding M_{CRIT}

For IFR operations:

Subject ref.:	Syllabus content:
010 00 00 00	**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
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE - INSTRUMENTATION**
022 01 02 00	Temperature sensing
022 03 04 00	Flux valve
022 12 00 00	**ALERTING SYSTEMS, PROXIMITY SYSTEMS**
022 12 07 00	Altitude alert system
022 12 08 00	Radio-altimeter
022 12 10 00	ACAS/TCAS principles and operation
022 13 03 01	Electronic flight instrument system (EFIS) — Design, operation
050 00 00 00	**METEOROLOGY**
050 02 06 03	Clear-air turbulence (CAT) - Description, cause and location
050 10 02 03	Upper-air charts
062 00 00 00	**RADIO NAVIGATION**
062 02 05 04	ILS — Errors 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 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.

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AMC2 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

An applicant for an additional class or type rating for a single-pilot aeroplane classified as a high performance aeroplane (HPA), who:

(a) has held a single-pilot HPA class or type rating prior to the application of Part FCL; and

(b) has completed a competency-based modular IR(A) course according to Appendix 6 Aa or EIR course according to FCL.825; and

(c) does not fulfil the requirements of FCL.720.A (b)(2)(ii) or (iii); should pass the theoretical knowledge instruction and examination for the VFR and IFR parts of the course required in accordance with FCL.720.A.(b)(2)(i).'

AMC1 FCL.725.A(b) Theoretical knowledge and flight instruction for the issue of class and type ratings – aeroplanes - RESERVED

Class rating sea - RESERVED

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 multicrew aircraft.

(c) Training should comprise both theoretical and practical elements and be designed to achieve the competencies/training objectives (see Table 1 below).

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Table 1 – Competencies/training objectives			
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; (g) Use appropriate body language, eye contact and tone; (h) Open and receptive to other people's view.	(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. (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. (d) Descent and approach: (1) instrument flight procedures; (2) holding; (3) precision approach using raw data; (4) precision approach using flight director;
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.		

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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.		(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; (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) Be 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.		

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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.	

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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; (d) Construct a mental model of the local ATC and weather environment.	(a) Systems; (b) SOPs; (c) ATC environment and phraseology; (d) Procedures for hazardous weather conditions.	

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Certificate of completion form

CERTIFICATE OF COMPLETION OF MCC				
Applicant's last name(s):		First name(s):		
Type of licence:		Number:		State:
ME/IR training completed		OR	ME/IR validity date: 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*

AMC2 FCL.735.A Multi-crew cooperation (MCC) training course – aeroplanes

ENCHANCED MCC TRAINING TO AIRLINE PILOT STANDARDS (APS MCC) COURSE

(a) The APS MCC training course should comprise both theoretical and practical elements and should be designed to achieve the training objectives, as set out in Table 1 below.

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Table 1 – Training objectives			
Training objectives	**Performance indicators**	**Knowledge**	**Practical exercises**
Monitoring and cross-checking	(a) Monitor and cross-check all actions; (b) Monitor aeroplane trajectory in critical flight phases; (c)Take appropriate actions in response to deviations from the flight path.	(a) SOPs; (b) Aeroplane systems; (c) Undesired aeroplane states.	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. (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. (d) Descent and approach: (1) instrument flight procedures;
Task sharing	(a) Apply SOPs in both PF and PM roles; (b) Make and respond to standard call-outs.	(a) PF and PM roles; (b) SOPs	
Use of checklists	Utilise checklist's 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 aeroplane automation state; (b) Manage automation to achieve optimum trajectory and minimum workload; (c) Take effective recovery actions from automation anomalies; (d) Manage aeroplane navigation, terrain clearance; (e) Manage aeroplane fuel state and take appropriate actions.	(a) Understanding of aeroplane 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.	

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FMS use	Programme, manage and monitor FMS in accordance with SOPs.	(a) Systems (FMS); (b) SOPs (c) Automation.	(2) holding; (3) 3D Operations using raw data; (4) 3D Operations using flight director; (5) 3D Operations using autopilot; (6) one-engine-inoperative approach; (7) 2D Operations and circling; (8) computation of approach and landing data; (9) all engines go-around; (10) go-around with one engine inoperative; (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.
Systems normal operations	Perform and monitor normal systems operations 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 air traffic control (ATC)	(a) communicate effectively with ATC; (b) Avoid misunderstandings by requesting clarification; (c) Adhere to ATC instructions; (d) Construct a mental mode of the local ATC and weather environment.	(a) Systems; (b) SOPs; (c) ATC environment and phraseology; (d) Procedures for hazardous weather conditions.	

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(b) The APS MCC training course should include advanced swept-wing jet aeroplane training and airline operations scenario training to equip a pilot with the knowledge, skills, and attitudes required to commence initial type rating training to the standards generally required by a commercial air transport (CAT) operator certified pursuant to Regulation (EU) No 965/2012 (the 'Air OPS Regulation').

(c) The APS MCC course should consist of the following:

(1) the content of the MCC training course;

(2) advanced swept-wing jet aeroplane training;

(3) advanced airline operations scenario training; and

(4) a final assessment.

(d) The flight simulation training device (FSTD) time per crew during practical training should be a minimum of 40 hours, or 35 for an integrated airline transport pilot licence (ATPL) holders, as set out in Table 2 below:

Table 2 – Minimum hours	
Training element	Minimum FSTD time per crew
MCC TRAINING	20 hours /15 hours
ADVANCED SWEPT-WING JET AEROPLANE TRAINING	12 hours
ADVANCED AIRLINE OPERATIONS SCENARIO TRAINING	6 hours
FINAL ASSESSMENT	2 hours

The training elements may be ordered, split and combined, as determined by the approved training organisation (ATO)'s course design.

(e) The ATO should provide generic stand-alone or CAT-operator-specific APS MCC training, advanced swept-wing jet aeroplane training and advanced airline operations scenario training. In the case of generic stand-alone training, the ATO should establish appropriate documentation and manuals representative of a CAT operator, such as manuals for aeroplane original-equipment manufacturers (OEMs), standard operating procedures (SOPs), flight documentation, as well as reporting and documentation for management systems.

FSTDs

(f) The practical training in the APS MCC training course should be based on a multi-pilot, multi-engine aeroplane type capable of carrying at least 50 passengers or equivalent mass. The FSTD used should be type-specific and equipped with a visual system that provides at least 180° horizontal and 40° vertical field of view. However, an FNPT II MCC that has a similar visual cueing system to the above or is approved for MCC pursuant to FCL.735.A may also be acceptable provided that the device is representative of the same class of multi-pilot, multi-engine aeroplane specified in this paragraph in terms of passenger load, mass and performance, and equipped with equivalent aeroplane systems and avionics functionality.

(g) In the case of advanced swept-wing jet aeroplane practical training, an FSTD representing a swept-wing multi-engine jet aeroplane should be used.

INSTRUCTOR QUALIFICATION

(h) The minimum qualification level of an instructor to deliver the training course should be an MCCI(A). The ATO should ensure that:

(1) all the instructors, before delivering the training course content, have received training on the application of core competencies as well as competency-based training; and

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(2) before the MCCI(A) delivers the advanced swept-wing jet handling or airline operations scenario training elements, they have satisfactorily completed relevant specific handling, systems and technical instructor training under the supervision of an SFI or TRI with the privilege to instruct for multi-pilot aeroplanes.

(i) The final assessment should be completed by an instructor nominated by the head of training (HT) for this purpose.

COURSE DESIGN AND CORE COMPETENCIES

(j) The course should be designed using instructional systems design (ISD) methodology.

(k) Progress should be monitored throughout the course in accordance with the course design.

(l) A final progress assessment should be conducted at the end of the practical training.

PROGRESS ASSESSMENTS AND COURSE COMPLETION CERTIFICATE

(m) Practical training and progress assessments should be conducted to ensure that the student pilot has demonstrated the required level of competency (see Tables 1, 2, 3, 4 and 5 of this AMC).

(n) During progress assessments, the student's knowledge, skills and attitudes in both pilot flying and pilot monitoring roles should be assessed; those assessments should be integrated into the training sessions.

(o) All assessments should be graded. An example of a grading system for the APS MCC is provided in GM3 FCL.735.A.

(p) For the final assessment, the minimum standard for each competency should be at least 'satisfactory'. 'Satisfactory' is defined as demonstrating 75 % or greater of the relevant performance indicators/observable behaviours set out in the table of GM3 FCL.735.A.

(q) A student pilot who has reached a satisfactory or higher standard at the final assessment of the practical training should be awarded the APS MCC course completion certificate pursuant to AMC2 FCL.735.A.

(r) Alternatively, a student pilot who completes the APS MCC course but does not achieve the APS MCC standard should be awarded the MCC course completion certificate pursuant to AMC1 FCL.735.A; FCL.735.H; FCL.735.As.

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APS MCC TRAINING COURSE CONTENT AND PERFORMANCE INDICATORS

(s) The elements of AMC1 FCL.735.A(c) should be enhanced as a result of the additional training in an airline context.

(t) CRM training should be provided to an APS MCC standard.

Table 3 – APS MCC CRM TRAINING CONTENT AND PERFORMANCE INDICATORS			
Training	Performance indicators	Knowledge	Practical exercises
CRM training	(a) Display competency in the relevant CRM-related behaviours. (b) Successfully complete the final check.	Understand the CRM concepts set out in ORO.FC.115 of BAR 6 Part-ORO to the AIR OPS Regulation.	Integrated CRM into all practical exercises of the APS MCC.

(1) The ATO should ensure that the student pilot understands how multi-crew coordination as well as the content and intent of CRM in ORO.FC.115 is applied in an airline context.

(2) In order to impart maximum learning to the student pilot, the ATO should ensure the following:

(i) CRM is integrated into all practical exercises of the APS MCC; and

(ii) Threat-and-error management (TEM) is central to the course instruction; the concepts of threat anticipation, threat recognition, recovery to safe flight, error management, and consequent avoidance of undesired aeroplanes states is emphasised at all times.

Table 4 – ADVANCED APS MCC FLYING TRAINING COURSE CONTENT AND PERFORMANCE INDICATORS			
Training	Performance indicators	Knowledge	Practical exercises
Advanced swept-wing flying training	(a) Understand and apply combinations of thrust and attitude that ensure a stable, safe flight in various aeroplane configurations and altitudes. (b) Manage the (much) wider range of speed and thrust at both low level and high level. (c) Demonstrate good judgement and correct use of lift and drag devices during various phases of the flight. (d) Use displays along with all available aids to stay mentally ahead when piloting all profiles. (e) Understand and recognise the precursors of high-energy approaches. (f) Know angle-of-attack (AoA) versus attitude indications at low level as well as at high level. (g) Practice upset prevention as a priority, and clearly recognise	Elements and components of jet orientation: (a) glass cockpit displays; (b) propulsion; (c) aerodynamics; (d) flight controls; (e) performance; (f) jet flight planning; (g) weight and balance; (h) basic jet flying; (i) pilot techniques for jet flying, advanced-handling-skills development; (j) flight path management; (k) auto flight; (l) high-altitude	(a) Take-off, approach, landing, go-around. (b) Flight deck management practices. (c) Complex problem- solving techniques. (d) Advanced handling. (e) Manual handling skills (no autopilot, no auto thrust, and where possible, no flight director). (f) Flight at different speeds, including slow flight and altitudes within the normal flight envelope. (g) Steep turns. (h) Aeroplane stability and stall awareness. (i) Upset prevention techniques and approach-to-stall recovery events (appropriate to FSTD limitations and capabilities). (j) High-energy approach

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	when and how recovery is necessary, by using the required pilot skills to mitigate loss of control in-flight (LOC-I) events.	operations; (m) introduction into prevention and recovery of upsets.	prevention. (k) Go-around management of approach and landing configurations.

Table 4 — ADVANCED APS MCC FLYING TRAINING COURSE CONTENT AND PERFORMANCE INDICATORS			
Training	Performance indicators	Knowledge	Practical exercises
Advanced airline operations scenario training	(a) Execute pre-flight preparation in accordance with airline or OEM SOPs. (b) Conduct an effective crew briefing, including cabin crew managers (CCMs). (c) Display good airmanship and TEM skills in assessing aeroplane serviceability, weather planning, fuel planning, and destination facilities. (d) Conduct cockpit preparation and briefings in an effective and accurate manner. (e) Manage and execute engine start, taxi-out and pre-take-off checks safely and in accordance with airline or OEM SOPs. (f) Manage and execute runway line-up, take-off, climb, cruising, descent, approach, landing and taxi-in safely and in accordance with airline or OEM SOPs. (g) During non-normal operations, display good system knowledge, and apply non- normal procedures, communications, TEM, situational awareness (SA), decision-making and aeroplane handling.	(a) Knowledge of systems as set out in this AMC. (b) SOPs. (c) Normal-and non-normal operations' checklists and procedures.	(a) CHECK-IN PROCEDURES. (b) PRE-FLIGHT PREPARATION: (1) weather analysis; (2) flight planning; (3) fuel planning; (4) configuration deviation list (CDL), dispatch deviation procedures guide (DDPG), and minimum equipment list (MEL) analysis; and (5) cabin crew briefing. (c) NORMAL PROCEDURES: cockpit preparation, pushback, engine starting, taxiing, take- off, climb, cruising, descent, landing, shutdown, and disembarkation procedures. (d) ON TIME PERFORMANCE: (1) weather analysis; (2) flight planning; and (3) fuel planning. (e) NON-NORMAL PROCEDURES: (1) as per (c) above, in case of a technical or operational non-normal event; (2) TEM; (3) diversion decision-making; (4) communication; (5) diversion; (6) fuel SA; and (7) passenger and crew care.

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Table 5 — ADVANCED APS MCC AIRLINE TRAINING CONTENT AND PERFORMANCE INDICATORS			
Training	Performance indicators	Knowledge	Practical Exercises
Airline-oriented training	(a) Understand the roles of airline departments. (b) Understand the challenges faced by airline departments. (c) Understand the relationships between airline departments. (d) Understand airline responsibilities. (e) Understand a pilot's responsibilities as a crew member.	Appropriate elements of the applicable Regulation (Regulation (EU) No 1178/2012 (the 'Aircrew Regulation') and the Air OPS Regulation).	The exercise should provide the student pilot with a practical understanding of airline operations. This may be achieved through a visit to an airline or alternative means.

Certificate of completion form

CERTIFICATE OF COMPLETION OF APS 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 APS 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*

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GM1 FCL.735.A Multi-crew cooperation (MCC) training course – aeroplanes

ENHANCED MCC TRAINING TO AIRLINE PILOT STANDARDS (APS MCC) COURSE

(a) The ATO should be responsible for the initial course design based on the instructional systems design (ISD) methodology, as well as for the integral evaluation and further development of the course.

(b) Technical-knowledge instruction

To maximise the benefit during the training in a flight simulation training device (FSTD), it is essential that the student pilot understands the aeroplane systems. Consequently, the approved training organisation (ATO) should provide sufficient systems training to ensure that student pilots are capable of effective situational awareness (SA) of the aeroplane systems when following normal and non-normal procedures and completing the related checklists. The standard of technical-knowledge training should be limited to this goal unless the course is part of a combined APS MCC/type rating course. ATOs providing APS MCC training in a combined APS MCC/type rating course may provide systems training up to type rating standard.

Aeroplane systems training may be delivered by any means provided that the training ensures knowledge transfer to a standard within the scope of the ATO's APS MCC training course approval. This training may be delivered either through distance learning or instructor-led classroom instruction or a combination thereof. If distance learning is utilised as an element of the course, it should be supplemented by instructor-led training.

Aeroplane systems knowledge at the required level should be confirmed by an assessment determined by the ATO's course design.

(c) Advanced swept-wing jet flying training (see Table 4 of AMC2 FCL.735.A)

The student pilot should develop a flight path management competency, including energy management, as pilot flying (PF), and associated active monitoring skills as pilot monitoring (PM). Aeroplane and airline procedures used during this training should develop the student pilot's understanding of the aeroplane flight envelope and inertia, as well as of the relationship between thrust and attitude. This phase should include an introduction to prevention and recovery of upsets, which builds confidence, skill, and resilience.

(d) Advanced airline operations scenario training (see Table 4 of AMC2 FCL.735.A)

(1) The student pilot should be trained to apply the core competencies to conduct a safe and efficient operation in realistic airline operations scenarios.

(2) The airline-representative scenarios should include normal and non-normal situations.

(3) Operations should be run in real time according to a typical schedule.

(4) The scenarios should be constructed in an airline context in order to emphasise the following:

(i) threat-and-error management (TEM);

(ii) crew resource management (CRM);

(iii) flight path management, including energy management; and

(iv) interaction with internal and external stakeholders in the resolution of scenarios.

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(e) Airline-oriented training (see Table 5 of AMC2 FCL.735.A)

The training should provide an understanding of the regulatory framework that an airline must operate in. The student pilot should understand the context and operational environment that applies to airline employees. Subjects should include but are not limited to the following:

(1) regulation of operations and aircrew;

(2) safety management systems (SMSs) with emphasis on the pilots reporting obligations and 'just culture';

(3) fatigue management and fatigue risk management system (FRMS) with emphasis on the airline's and pilot's obligations;

(4) flight time limitations (FTLs), including crew scheduling and crew control functions;

(5) flight operations planning and flight watch reporting systems;

(6) airline maintenance department and interaction with flight operations;

(7) ground operations and interaction with flight operations; and

(8) in-flight department and interaction with flight operations.

GM2 FCL.735.A Multi-crew cooperation (MCC) training course – aeroplanes

ENCHANCED MCC TRAINING TO AIRLINE PILOT STANDARDS (APS MCC) COURSE

The approved training organisation (ATO) should ensure that their course design develops the required core competencies through their training and assessment plan based on the competency framework provided in Table 1 below. An ATO may adapt this framework to include additional competencies and/or performance indicators/observable behaviours

Table 1 – COMPETENCIES		
Competency	Description	Performance indicators/observable behaviours
Application of knowledge	Relates and applies relevant knowledge in the operational environment and in scenario settings.	– Demonstrates the acquisition and retention of required aviation knowledge; – Relates knowledge between subject areas; – Applies knowledge to the operational environment; – Correctly identifies threats and errors in a timely manner; – Uses knowledge to create valid options of managing threats, errors, and undesirable aeroplane states; – Mentally resolves basic-mathematics problems relating to operational situations, both under normal circumstances and under pressure; – Shares knowledge with others openly and constructively, as and when appropriate.
Application of regulations and procedures	Identifies and applies appropriate procedures in accordance with	– Identifies where to find the information; – Follows standard operating procedures (SOPs) unless a higher degree of safety dictates an appropriate deviation therefrom;

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Table 1 – COMPETENCIES		
Competency	Description	Performance indicators/observable behaviours
	published operating instructions and pursuant to applicable regulations.	– Follows all operating instructions in a timely manner; – Correctly operates aeroplane systems and associated equipment; – Monitors the status of aeroplane systems; – Complies with applicable regulations; – Applies relevant procedural knowledge.
Communication	Communicates through appropriate means in normal and non-normal situations.	– Ensures that the recipient is ready and able to receive the information; – Shares appropriate information; – Selects appropriately what, when, how, and with whom to communicate; – Conveys messages clearly, accurately, and concisely; – Confirms that the recipient correctly understands important information; – Listens actively and demonstrates understanding when receiving information; – Asks relevant and effective questions; — Communicates in order to resolve deviations identified through monitoring; – Adheres to standard radiotelephony phraseology and procedures; – Accurately reads, interprets, drafts, and responds to data link messages in English; – Correctly uses and interprets non-verbal communication.
Aeroplane flight path management — automation	Controls the aeroplane flight path through automation.	– Uses appropriate flight management and guidance systems as well as automation, as installed and as appropriate to the conditions; – Monitors and detects deviations from the desired aeroplane trajectory and takes appropriate action; – Manages the flight path to optimise the operational performance; – Maintains the desired flight path during flight using automation, whilst managing other tasks and distractions; – Effectively monitors automation, including engagement and automatic-mode transitions.
Aeroplane flight Path management — manual control	Controls the aeroplane flight path through manual flight.	– Uses appropriate flight management and guidance systems and automation, as installed and appropriate to the conditions; – Manually controls the aeroplane using only the

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Table 1 – COMPETENCIES		
Competency	Description	Performance indicators/observable behaviours
		relationship between aeroplane attitude, speed and thrust, as well as navigation signals or visual information; – Monitors and detects deviations from the desired aeroplane trajectory and takes appropriate action; – Manages the flight path to optimise the operational performance; – Maintains the desired flight path during manual flight, whilst managing other tasks and distractions; – Effectively monitors flight guidance systems, including engagement and automatic-mode transitions.
Leadership and teamwork	Influences others so that they contribute to a shared purpose. Collaborates to accomplish the goals of the team.	– Creates an atmosphere of open communication and encourages team participation; – Displays initiative and gives directions when required; – Admits mistakes and takes responsibility; – Carries out instructions when directed; – Gives and receives feedback constructively; – Applies effective intervention strategies to resolve deviations identified whilst monitoring; – Takes into account cultural differences; – Engages others in planning; – Addresses and resolves conflicts and disagreements in a constructive manner; – Exercises decisive leadership.
Problem-solving and decision-making	Identifies problem precursors and resolves actual problems, using decision-making techniques, in a timely manner.	– Seeks accurate and appropriate information from appropriate sources; – Identifies and verifies what and why has failed; – Perseveres with resolving problems whilst prioritising safety; – Uses appropriate and timely decision-making techniques; – Sets priorities appropriately; – Identifies and considers options, as appropriate; – Monitors, reviews, and adapts decisions, as required; – Identifies, assesses, and manages risks effectively; – Adapts when faced with situations where no guidance or procedure exists.
Situational awareness (SA) and information management	Perceives, comprehends, and manages information, as well as anticipates its effect on the operation.	– Monitors, identifies, and assesses accurately the aeroplane’s state and systems; – Monitors, identifies, and assesses accurately the aeroplane’s energy state and anticipated flight path; – Monitors, identifies, and assesses accurately the general environment as it may affect the operation;

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Table 1 – COMPETENCIES		
Competency	Description	Performance indicators/observable behaviours
		– Validates the accuracy of information and checks for gross errors; – Maintains the awareness of the people involved in or affected by the operation as well as their capacity to perform as expected; – Anticipates what could happen, plans, and stays ahead of the situation; – Develops effective contingency plans based upon potential threats; – Recognises and effectively responds to indications of reduced SA.
Workload management	Maintains available workload capacity through prioritisation and distribution of tasks, using resources.	– Exercises self-control in all situations; – Plans, prioritises, and schedules tasks effectively; – Manages time efficiently when carrying out tasks; – Offers and gives assistance, delegates when necessary; – Seeks and accepts assistance, when necessary; – Monitors, reviews, and cross-checks taken action conscientiously; – Verifies that tasks are completed as expected; – Manages and recovers from interruptions, distractions, variations, and failures effectively, while performing tasks.

GM3 FCL.735.A Multi-crew cooperation (MCC) training course – aeroplanes

EXAMPLE OF AN ENCHANCED MCC TRAINING TO AIRLINE PILOT STANDARDS (APS MCC) GRADING SYSTEM

EXAMPLE OF AN APS MCC GRADING SYSTEM					
Competency	Unsatisfactory	Satisfactory	Good	Very Good	Exemplary
General description of each competency level.	The pilot's performance in this competency was unsatisfactory with a negative effect on safety. The pilot did not demonstrate the majority of the relevant performance indicators.	The pilot's performance in this competency was satisfactory with a slightly positive effect on safety. The pilot demonstrated most of the relevant performance indicators in this competency	The pilot's performance in this competency was effective with a significant contribution to safety. The pilot consistently demonstrated most of the relevant performance indicators in this	The pilot's performance in this competency was very effective, which significantly enhanced safety. The pilot regularly demonstrated all of the relevant performance indicators in	The pilot's performance in this competency was exemplary with an outstanding effect on safety. The pilot always demonstrated all of the relevant performance indicators in this

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EXAMPLE OF AN APS MCC GRADING SYSTEM					
Competency	Unsatisfactory	Satisfactory	Good	Very Good	Exemplary
		to at least a satisfactory standard.	competency to a good standard.	this competency to a very good standard.	competency to an exemplary standard.
Notes			— Most: 75 % or greater. — Relevant performance indicator: a performance indicator/observable behaviour that is expected to be demonstrated during the assessment.		

GM4 FCL.735.A Multi-crew cooperation (MCC) training course – aeroplanes

ENCHANCED MCC TRAINING TO AIRLINE PILOT STANDARDS (APS MCC) TRAINING – SPECIFIC ARRANGEMENT

The specific arrangement, pursuant to ORA.GEN.205, between an approved training organisation (ATO) and an operator for the APS MCC course should cover at least the following points:

(1) pre-entry requirements (including screening and selection);

(2) provision of the relevant documentation (operations manuals (OMs) and training manuals);

(3) design of the training programme;

(4) content of the course, including criteria to ensure that the operator's documentation, manuals, standard operating procedures (SOPs), reporting structures, and management system are represented throughout the training course;

(5) training effectiveness;

(6) performance data feedback from the ATO to the operator;

(7) course evaluation and improvement;

(8) alignment of the grading and assessment criteria; and

(9) use of the operator's crew resource management (CRM) content and utilisation of a flight crew CRM trainer, standardised by the operator.

The ATO and the operator may use their OMs and training manuals to identify additional areas to be covered by the specific arrangement.

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AMC1 FCL.740.A(b)(1)(ii) Revalidation of class and type ratings

CONTENT OF THE REFRESHER TRAINING

Training flight items should be based on the exercise items of the proficiency check, as deemed relevant by the instructor, and depending on the experience of the candidate. The briefing should include a discussion on TEM with special emphasis on decision-making when encountering adverse meteorological conditions or unintentional IMC, as well as on navigation flight capabilities.

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AMC1 FCL.745.A Advanced UPRT course – aeroplanes

COURSE OBJECTIVE AND CONTENT

COURSE OBJECTIVE

(a) The objective of the course is for the pilot under training:

(1) to understand how to cope with the physiological and psychological aspects of dynamic upsets in aeroplanes; and

(2) to develop the necessary competence and resilience to be able to apply appropriate recovery techniques during upsets.

(b) In order to meet the objective as specified in point (a), the course should:

(1) emphasise physiological and psychological effects of an upset and develop strategies to mitigate those effects;

(2) be delivered in a suitable training aircraft in order to expose trainees to conditions that cannot be replicated in an FSTD; and

(3) employ recovery techniques that are suitable for the aircraft used for training in order to support the training objectives. In order to minimise the risk associated with potential negative transfer of training, the recovery techniques used during the course should be compatible with techniques typically used for transport category aeroplanes.

THEORETICAL KNOWLEDGE

(c) Theoretical knowledge instruction supports the objectives of the course and should include the following:

(1) a review of basic aerodynamics typically applicable to aeroplane upsets in transport category aeroplanes, including case studies of incidents involving potential or actual upsets.

(2) aerodynamics relevant to the aeroplane and exercises used in the practical training, including differences to aerodynamics as referred to in point (1);

(3) possible physiological and psychological effects of an upset, including surprise and startle effect;

(4) strategies to develop resilience and mitigate startle effect; and

(5) memorising the appropriate procedures and techniques for upset recovery.

FLIGHT INSTRUCTION

(d) Flight instruction should include:

(1) exercises to demonstrate:

(i) the relationship between speed, attitude and AoA;

(ii) the effect of g-load on aeroplane performance, including stall events at different attitudes and airspeeds;

(iii) aerodynamic indications of a stall including buffeting, loss of control authority and inability to arrest a descent;

(iv) the physiological effects of different g-loads between -1 and 2.5G; and

(v) surprise and the startle effect;

(2) training in techniques to recover from:

(i) nose high at various bank angles;

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(ii) nose low at various bank angles;

(iii) spiral dives;

(iv) stall events; and

(v) incipient spin; and

(3) training to develop resilience and to employ strategies to mitigate the startle effect.

COURSE COMPLETION

(e) The course is considered to have been satisfactorily completed if the trainee is able to successfully:

(1) apply strategies to mitigate psychological and physical effects;

(2) recognise upsets;

(3) apply correct recovery techniques from upset scenarios as specified in point (d)(2).

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GM1 FCL.745.A Advanced UPRT course – aeroplanes

UPSET RECOVERY TRAINING EXERCISES

GENERAL

(a) The objective of this GM is to provide instructors with further guidance on the conduct of the various upset recovery exercises, which requires instructor performance beyond that experienced in normal operations.

(b) Instructors should:

(1) ensure that the risk mitigation measures determined by the ATO are strictly adhered to;

(2) continuously assess the performance of the student to ensure that the training objectives of the upset recovery exercises are achieved;

(3) understand that all-attitude/on-aeroplane upset recovery exercises serve primarily as resilience-builder. In other words, the training serves mainly human-factor training objectives and not only flying skills training;

(4) understand the differences between all-attitude UPRT and aerobatics training;

(5) have knowledge and understanding of how:

(i) on-aeroplane and FSTD UPRT complement each other; and

(ii) to ensure that negative transfer of training from small aeroplanes to heavier transport category aeroplanes is avoided. This may be achieved by observing UPRT in an FSTD, especially in a type-specific FFS; and

(6) have knowledge and understanding of the upset prevention theoretical knowledge and flight instruction elements taught during the CPL(A) and ATPL(A) training courses to ensure continuity and consistency in delivering UPRT.

Note: Instructors should be aware that the safety and potential human factor implications of poor upset recovery instructional technique or misleading information are more significant than in any other areas of pilot training.

(c) In order to increase the applicant's resilience related to the handling of aeroplane upsets, the advanced UPRT course needs to include the development of confidence and competence in recognising and recovering safely from upsets under the presence of the real human factors. Such confidence building is specifically addressed by:

(i) successfully overcoming natural stress response (startle and surprise); and

(ii) performing critically important counter-intuitive actions. Advanced UPRT therefore considers pitch attitudes, bank angles, AOA/airspeeds, sideslip and g-loads, none of which are normally experienced during routine operations.

(d) Aeroplanes used in this course should be:

(1) appropriately certified and operated by the ATO in a manner that takes into account the effects of repeated training manoeuvres on airframe fatigue life; and

(2) provide sufficient safety margins to cater for student and instructor errors.

(e) This course complements UPRT in FSTDs by providing exposure to psycho-physiological conditions, which cannot be delivered by the motion systems of today's qualified FSTDs. At completion of the course, the student should pilot to be able to:

(1) recognise and confirm the upset-situation;

(2) manage stress response;

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(3) apply the correct recovery strategy timely and effectively;

(4) stay within the defined training envelope;

(5) stabilise the flight path after recovery; and

(6) become competent and confident in recovering from upsets.

SPECIFIC EXERCISES

(f) Exercise 1 – Nose HIGH recovery

Exercise 1 Recovery from **Nose HIGH** upsets at various bank angles	
(1) Training objectives	The student pilot should: (i) recognise and confirm the Nose HIGH situation (AOA, attitude, energy, trends); (ii) announce 'Nose High'; and (iii) apply the correct recovery strategy.
(2) Training tasks	The student pilot should: (i) regain situation awareness; (ii) recognise and analyse AOA, pitch, bank, energy state and trends; (iii) note natural and synthetic indications for AOA, attitude, and energy; (iv) manage human factors, stress response (startle and surprise, counter-intuitive actions); (v) take manual control; (vi) identify and apply the Nose HIGH recovery strategy; (vii) correct any out-of-trim condition; (viii) manage nose-down movement; (ix) manage g-load; (x) use the effects of power to assist nose-down movement; (xi) use bank to orient the lift vector as necessary; (xii) stabilise the flight path after recovery using basic pitch/power settings;
(3) Enabling objectives	The student pilot should: (i) decide if Stall Recovery or Nose HIGH recovery is applicable; (ii) perform control inputs deliberately; (iii) use up to full control deflections; (iv) avoid unnecessary low or high loads; (v) use secondary flight controls (trim/power) as necessary to support primary flight control inputs (i.e. nose-down movement); (vi) apply control inputs in the correct sequence (see Table 1, Nose-HIGH Recovery Strategy); (vii) apply counter- intuitive actions as necessary: (A) unloading; (B) power-reduction in Nose-HIGH attitude (depending on engine mounting); and (C) using bank to orient the lift vector downwards.

Note: Refer to GM1 to Appendix 9, Table 2: Recommended nose-high recovery strategy templete.

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(g) Exercise 2 – Nose LOW Recovery

Exercise 2 Recovery from **Nose LOW** upsets at various bank angles	
(1) Training objectives	The student pilot should: (i) recognise and confirm the situation (AOA, attitude, energy, trends); (ii) announce 'Nose LOW'; (iii) apply the correct recovery strategy.
(2) Training tasks	The student pilot should: (i) regain situation awareness; (ii) recognise and analyse AOA, pitch, bank, energy state and trends; (iii) note natural and synthetic indications for AOA, attitude and energy; (iv) manage human factors, stress response (startle and surprise, counter-intuitive actions); (v) take manual control; (vi) identify and apply the Nose LOW recovery strategy; (vii) correct out-of-trim condition; (viii) decide if aircraft is stalled; (ix) manage g-load; (x) identify the correct direction to roll; (xi) roll to wings level to orient the lift vector upwards; (xii) manage power and drag; and (xiii) stabilise the flight path after recovery using basic pitch/power settings
(3) Enabling objectives	The student pilot should: (i) perform control inputs deliberately; (ii) use up to full control deflections; (iii) avoid unnecessary low or high loads; (iv) apply control inputs in the correct sequence (see Table 2, Nose-LOW Recovery Strategy); and (v) apply counter-intuitive actions as necessary: (A) apply Stall Recovery in nose low attitude first if needed; (B) unloading instead of pulling; (C) unloading to increase roll rate; (D) avoid 'rolling-pull'; and (E) accept the priority of rolling to wings level first, before reducing power and before pulling.

Note: Refer to GM1 to Appendix 9, Table 3: Recommended nose-low recovery strategy template.

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(h) Exercise 3 – Recovery from spiral dive

Exercise 3 Recovery from Spiral Dive	
(1) Training objectives	The student pilot should: (i) recognise the spiral dive as a result of improper nose-up elevator input during a Nose LOW turning situation; and (ii) apply the Nose LOW Recovery Strategy.
(2) Training tasks	The student pilot should: (i) maintain/regain situation awareness; (ii) recognise and analyse AOA, pitch, bank, energy state and trends; (iii) manage human factors, stress response (startle and surprise, counter-intuitive actions); (iv) take manual control; (v) identify and apply the Nose LOW recovery strategy; and (vi) stabilise the flight path after recovery using basic pitch/power settings.
(3) Enabling objectives	The student pilot should: (i) perform control inputs deliberately and in the correct sequence; (ii) use up to full control deflections, if required; and (iii) apply counter-intuitive actions as necessary: (A) unloading instead of pulling; (B) unloading to increase roll rate; (C) avoid 'rolling-pull'; and (D) accepting the priority of rolling to wings level first, before reducing power and before pulling.

(i) Exercise 4 – Stall Event Recovery

Exercise 4 Recovery from Stall event	
(1) Training objectives	The student pilot should: (i) recognise and confirm the situation (AOA, attitude, energy, trends); (ii) announce 'Stall'; (iii) apply the Stall Event Recovery Strategy
(2) Training tasks	The student pilot should: (i) regain situation awareness; (ii) recognise and analyse AOA, pitch, bank, energy state and trends; (iii) note natural and synthetic indications for high AOA/stall; (iv) manage human factors, stress response (startle and surprise, counter-intuitive actions); (v) recover from: (A) approach to stall (B) full stall, wings level and during turn (C) slipping stall (D) skidding stall (E) accelerated stall (F) secondary stall (vi) take manual control; (vii) identify and apply the Stall Event Recovery Template or

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Exercise 4 Recovery from Stall event	
	the aircraft manufacturer Stall Recovery SOP; (viii) apply nose-down elevator input to reduce AOA; (ix) manage trim; (x) consider power reduction (if engine mounting induces a nose-up effect); (xi) accept altitude loss; (xii) identify the correct direction to roll to wings level; (xiii) manage power and drag; (xiv) manage g-load and energy to avoid secondary stall; and (xv) stabilise the flight path after recovery using basic pitch/power settings.
(3) Enabling objectives	The student pilot should: (i) perform control inputs deliberately; (ii) use up to full control deflections; (iii) apply control inputs in the correct sequence (see Table 3, Stall Event Recovery Strategy Template); and (iv) apply counter-intuitive actions as necessary: (A) unloading to reduce AOA; (B) unloading before rolling; (C) power reduction if necessary; (D) accepting altitude loss; and (E) waiting for airspeed increase before loading again.

Note: Refer to GM1 to Appendix 9, Table 1: Recommended stall event recovery template.

(j) Exercise 5 – Recovery from spin

Exercise 5 Recovery from incipient spin	
(1) Training objectives	The pilot should: (i) recognise and confirm the spin (AOA, yaw, attitude, energy, roll, trends); (ii) apply the OEM Incipient Spin Recovery procedure.
(2) Training tasks	The pilot should: (i) be aware of the aircraft response to all possible pitch and roll control inputs and to thrust/power changes during (incipient) spin; (ii) maintain/regain situation awareness; (iii) recognise and analyse AOA, attitude, energy, yaw, roll, trends); (iv) note natural and synthetic indications for high AOA, stall, spin; (v) manage human factors, stress response (startle and surprise, counter-intuitive actions); (vi) take manual control; (vii) identify and apply the OEM Incipient Spin Recovery Procedure; (viii) manage AOA, g-load and energy to avoid secondary stall; and

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Exercise 5 Recovery from incipient spin	
	(ix) stabilise the flight path after recovery using basic pitch/power settings.
(3) Enabling objectives	The pilot should: (i) perform control inputs deliberately and in the correct sequence; (ii) use up to full control deflections as required by the procedure; (iii) apply counter-intuitive actions as necessary; (iv) avoid unreflected control inputs; and (v) allow time for control inputs to show results.

(k) Assessment of student performance

By collecting evidence from observable behaviours, the instructor will continuously assess whether the student meets the required competency standards under the given conditions.

Pilot competencies and behavioural indicators in the context of the Advanced UPRT course

(1) Application of procedures

(i) Follows the recommended Nose HIGH or Nose LOW recovery strategy or the Stall Event Recovery Template / STALL RECOVERY SOP

(ii) Identifies and follows operating instructions in a timely manner

(iii) Correctly operates aircraft systems and equipment

(iv) Applies relevant procedural knowledge

(2) Communication

(i) Adheres to callouts

(ii) Verbalises the essential steps during the recoveries

(3) Aeroplane flight path management — automation

Disconnects autopilot and autothrust/autothrottle before initiating the recovery (to be simulated if the training aeroplane is not fitted with autothrust/autothrottle)

(4) Aeroplane flight path management — manual control

(i) Detects deviations from the desired aircraft trajectory and takes appropriate action

(ii) Controls the aircraft using appropriate attitude and power settings

(iii) Contains the aircraft within the defined flight envelope

(5) Leadership and teamwork

(i) Understands and agrees with the crew's roles and objectives

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Pilot competencies and behavioural indicators in the context of the Advanced UPRT course

(ii) Uses initiative and gives directions when required

(iii) Admits mistakes and takes responsibility

(iv) Communicates relevant concerns and intentions

(v) Gives and receives feedback constructively

(vi) Projects self-control in all situations

(6) Problem-solving and decision-making

(i) Seeks accurate and adequate information from appropriate sources

(ii) Identifies and verifies what and why things have gone wrong

(iii) Perseveres in working through the event safely

(iv) Sets priorities appropriately

(7) Situation awareness and information management

(i) Identifies and assesses accurately the state of the aircraft and its systems

(ii) Identifies and assesses accurately the aircraft's vertical and lateral position, and its anticipated flight path

(iii) Anticipates accurately what could happen, plans and stays ahead of the situation

(iv) Recognises and effectively responds to indications of reduced situation awareness.

(8) Workload management

(i) Maintains self-control in all situations Manages and recovers from stress response (startle surprise), interruptions, distractions, variations and errors effectively

(ii) Reviews, monitors and cross-checks actions conscientiously

(iii) Verifies that tasks are completed to the expected outcome

(iv) Offers and accepts assistance, delegates when necessary, and asks for help early

(v) Manages and recovers from interruptions, distractions, variations and failures effectively

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SECTION 3 – SPECIFIC REQUIREMENTS FOR THE HELICOPTER CATEGORY

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 multicrew aircraft.

(c) Training should comprise both theoretical and practical elements and be designed to achieve the competencies/training objectives (see Table 1 below).

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Table 1 – Competencies/training objectives			
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; (g) Use appropriate body language, eye contact and tone; (h) Open and receptive to other people's view.	(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. (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. (d) Descent and approach: (1) instrument flight procedures; (2) holding; (3) precision approach using raw data; (4) precision approach using flight director;
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.		

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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.		(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; (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) Be 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.		

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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.	

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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; (d) Construct a mental model of the local ATC and weather environment.	(a) Systems; (b) SOPs; (c) ATC environment and phraseology; (d) Procedures for hazardous weather conditions.	

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Certificate of completion form

CERTIFICATE OF COMPLETION OF MCC				
Applicant's last name(s):			First name(s):	
Type of licence:			Number:	State:
ME/IR training completed		OR	ME/IR validity date: 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*

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

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Manufacturer	Helicopter type and licence endorsement
Hiller	
SEP	UH12
Hughes or Schweizer	
SEP	HU269
Westland	
SEP	Bell47

SECTION 4 – SPECIFIC REQUIREMENTS FOR THE POWERED-LIFT AIRCRAFT CATERGORY - RESERVED

GM1 FCL.720.PL Experience requirements and prerequisites for the issue of type ratings - powered-lift aircraft - RESERVED

SECTION 5 – SPECIFIC REQUIREMENTS FOR THE AIRSHIP CATEGORY – RESERVED

AMC1 FCL.735.A; FCL.735.H; FCL.735.As Multi-crew cooperation (MCC) training course - RESERVED

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Subpart I - Additional Ratings

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 DTO or 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, 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 manoeuvres;

(iv) looping manoeuvres;

(v) combination manoeuvres;

(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:

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(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.

AMC1 FCL.805 Sailplane towing and banner towing rating - RESERVED

AMC1 FCL.810(a) Night rating

Aeroplane night rating course

(a) The aim of the course is to qualify holders of Part-FCL licences with privileges to fly aeroplanes to exercise their privileges at night.

(b) The ATO or DTO 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, 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; and

(14) danger from icing conditions, as well as from avoidance and escape manoeuvres.

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(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 7 of the night rating flight syllabus should be completed in an aeroplane.

(2) For exercises 1 to 3, up to 50 % of the required flight training may be completed in an FSTD(A). However, each item of exercises 1 to 3 should be completed in an aeroplane in flight.

(3) Starred items (*) 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 from visual flight to instrument flight*; and

(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 night take-off techniques;

(B) explain and demonstrate night circuit techniques;

(C) explain and demonstrate night approaches with or without visual approach aids; and

(D) practise take-offs, circuits, as well as approaches and landings;

(v) exercise 5: explain and demonstrate night emergency procedures including:

(A) simulated engine failure (to be terminated with recovery at a safe altitude);

(B) simulated engine failure at various phases of flight;

(C) simulated inadvertent entry to IMC (not on base leg or final approach);

(D) internal and external lighting failure; and

(E) other malfunctions and emergency procedures, as required by the AFM;

(vi) exercise 6: solo night circuits; and

(vii) exercise 7:

(A) explain and demonstrate night cross-country techniques; and

(B) practise night cross-country dual flight and optionally supervised solo to a satisfactory standard.

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AMC1 FCL.810(b) Night rating

Helicopter night rating course

(a) The aim of the course is to qualify helicopter licence holders to exercise the privileges of the licence at night.

(b) The DTO or 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 in a helicopter in flight.

(2) For exercises 1 to 3, up to 50 % of the required flight training may be completed in an FSTD(H). However, each item of exercises 1 to 3 should be completed 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*.

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(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-offs, 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 flight and either flight as SPIC or supervised solo to a satisfactory standard

AMC1 FCL.815 Mountain rating - RESERVED

AMC2 FCL.815 Mountain rating - RESERVED

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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, 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

(a) 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 MD 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:

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(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

(a) 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_{mcq} and V_{mu};

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CONDITION 1 - AEROPLANES		
		(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)	

(b) 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.

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CONDITION 2 - AEROPLANES		
	(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

(a) 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: (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 engine governing; (2) turbine or piston engine evaluation.

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CONDITION 1 - HELICOPTERS		
	(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)	

(b) 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.

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CONDITION 2 - HELICOPTERS		
	(d) systems (at least one flight test report should be developed)	at least three different systems, for example: (1) navigation management should be 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)	

AMC1 FCL.825(a) En-Route instrument rating (EIR) (deleted)

AMC1 FCL.825(c) En-route instrument rating (EIR) (deleted)

AMC1 FCL.825(d) En-route instrument rating (EIR) (deleted)

AMC2 FCL.825(d) En-route instrument rating (EIR) (deleted)

AMC3 FCL.825(d) En-route instrument rating (EIR) (deleted)

GM1 FCL.825(d) En-route instrument rating (EIR) (deleted)

AMC1 FCL.825(e); (g) En-route instrument rating (EIR) (deleted)

AMC1 FCL.825(g)(2) En-route instrument rating (EIR) (deleted)

AMC1 FCL.825(h) En-route instrument rating (EIR) (deleted)

AMC2 FCL.825(h) En-route instrument rating (EIR) (deleted)

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AMC1 FCL.825(i) En-route instrument rating (EIR)

AMC1 FCL.830 Sailplane Cloud Flying Rating - RESERVED

AMC2 FCL.830 Sailplane Cloud Flying Rating – RESERVED

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AMC1 FCL.835 Basic instrument rating (BIR)

BASIC INSTRUMENT RATING (BIR) COMPETENCIES

This AMC provides the competency criteria required for the relevant training modules of the BIR.

(a) Modules

The following modules are applicable:

(1) Module 1: Pre-flight operations and general handling;

(2) Module 2: Departure, precision (3D) approach procedures and non-precision (2D) approach procedures;

(3) Module 3: En-route IFR procedures;

(4) Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only).

Upon completion of the training, an applicant for a BIR should have received instruction on the same class of aeroplane to be used in the test.

(b) Flight tolerances

The following limits should apply and it should be borne in mind that such tolerances are expected only at the end of the training. Due consideration should be given 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 or altitude	+ 50 feet/– 0 feet
Minimum descent height, MAP or altitude	+ 50 feet/– 0 feet
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 one time the RNP value are allowable.
3D linear vertical deviations (e.g. RNP APCH (LNAV/VNAV) using Baro VNAV)	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

Given that the intention of the training for the BIR is to be entirely competency-based, the student and instructor need detailed guidance on these competencies. The following information is intended to provide that guidance. Each element of the training modules is described in text followed by a table which gives guidance on the competencies required and how to assess them using the key competencies model of:

OBJECTIVE (of the training item), and **SKILL** — **KNOWLEDGE** — **ATTITUDE** (to achieve the objective)

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(c) Sample table

The table is separated into four rows as follows:

Training element	
Title of assessed item taken from training module	
OBJECTIVE	This cell describes the applicant's proficiency to be assessed by the training organisation or instructor.
SKILL	This cell describes the competency criteria that involve the applicant demonstrating: — manual aircraft control; — effective flight path management through proper use of flight management system guidance and automation; and — application of procedures
KNOWLEDGE	This cell describes the knowledge needed to meet the objective's proficiency requirements.
ATTITUDE	This cell describes the competency criteria encapsulated by airmanship, crew resource management (CRM), and threat and error management (TEM), such as: — situation awareness; — effective communication; — leadership and teamwork; — effective workload management; — effective problem-solving and decision-making.
General	
In most phases of flight there are competencies that apply to a group of manoeuvres, e.g. turns, or even to the whole phase of flight. In order to avoid repetition, the common competencies are grouped under the 'General' item heading.	

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(d) Content of the training

(1) Module 1: Pre-flight operations and general handling

Use of flight manual (or equivalent), especially for aircraft performance calculation, and mass and balance

Module 1: Pre-flight operations and general handling	
Use of flight manual (or equivalent), especially for aircraft performance, and mass and balance	
OBJECTIVE	(A) Proficient in the use of the flight manual (or equivalent). (B) Proficient in the mass and balance schedule. (C) Proficient in the aircraft performance calculation.
SKILL	(A) Use proficiently performance charts, tables, graphs or other data, when available, relating to items such as: (1) accelerate-stop distance available; (2) landing distance available; (3) take-off performance; (4) one engine inoperative; (5) climb performance; (6) cruise performance; (7) fuel consumption, range, and endurance; (8) go-around from rejected landing; (9) operational factors affecting aircraft performance; (10) other performance data appropriate to the test aircraft; (11) airspeeds used during specific phases of flight; (12) effects of meteorological conditions upon performance characteristics and correctly application of these factors to a specific chart, table, graph or other performance data; (13) impact of relevant NOTAMs on the conduct of the flight; (14) aircraft documentation.
KNOWLEDGE	(A) Part-NCO (non-commercial air operations) (B) Pilot operating manual (POM) or flight manual chapters dedicated to: (15) limitations; (16) performance calculation in general; (17) performance calculation and associated procedures when specific conditions exist.
ATTITUDE	(A) Situation awareness: Understand the responsibilities of proper pre-departure planning and preparations. (B) Effective communication: Ensure appropriate and clear communication with all ground service personnel (ATC, dispatch, MET). (C) Leadership and teamwork: Manage passengers and ground personnel, as applicable. (D) Effective workload management: Provide sufficient time and manage the workload for pre-flight procedures (including documentation) to be completed in an efficient manner. (E) Effective problem-solving and decision-making: (1) Make appropriate decisions on all identified threats; (2) Plan and implement suitable mitigation actions.

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Pre-flight inspection

Module 1: Pre-flight operations and general handling	
Pre-flight inspection	
OBJECTIVE	Full initial pre-flight inspection in accordance with the approved checklist assuming the risk to IFR flights such as icing conditions, database, etc.
SKILL	(A) Perform all elements of the aeroplane pre-flight inspections. (B) Confirm that the aeroplane is in a serviceable and safe condition for IFR flight.
KNOWLEDGE	(A) Confirm the validity of database and receiver autonomous integrity monitoring (RAIM) prediction, if applicable. (B) Be aware of the possible effects of equipment defects or unserviceability
ATTITUDE	(A) Situation awareness: (1) Note the position of the aircraft, any surrounding hazards, and location of emergency equipment, and take appropriate action to minimise potential risks; (2) Note effects of engine start on the surrounding environment; (3) Note the limitations of software and equipment such as flight director (FD), autopilot (AP), etc. (B) Effective communication: (1) Demonstrate correct communication; (2) Make a correct passenger and departure briefing. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: (1) Confirm from the checklist that all pre-flight requirements have been fulfilled; (2) Demonstrate an organised approach to performing inspection of aircraft and equipment. (E) Effective problem-solving and decision-making: (1) Identify possible defects and threats; (2) Take corrective action.

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Taxiing

Module 1: Pre-flight operations and general handling	
Taxiing	
OBJECTIVE	(A) Be proficient in all recommended taxiing checks and procedures. (B) Comply with ATC instructions, airport markings and signals.
SKILL	(A) Obtain appropriate clearance before taxiing and before crossing or entering active runways. (B) Comply with instructions issued by ATC. (C) Maintain correct and positive aircraft control. (D) Take due consideration of environmental conditions (e.g. surface wind, contamination, surface condition, etc.). (E) Maintain adequate separation from other aircraft, obstructions, and persons. (F) Accomplish the applicable briefing or checklist items, and follow the recommended procedures.
KNOWLEDGE	(A) The need to correctly perform taxiing checks. (B) Understanding the following: (1) runway hold lines and stop bar lighting as applicable; (2) localiser and glide slope sensitive and critical areas; (3) beacons, as well as other surface control markings and lighting; (4) taxiing speeds; (5) rules and procedures in the event of loss of communication (priority, lighting signals); (6) rules for manoeuvring in reduced meteorological conditions.
ATTITUDE	(A) Situation awareness: (1) Maintain constant vigilance and lookout during the taxiing operation; (2) Use headings in poor visibility conditions to confirm the path; (3) Maintain awareness of taxiing speeds appropriate to the conditions and limitations. (B) Effective communication: Demonstrate correct ATC communication (where applicable). (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Divide attention properly inside and outside the cockpit. (E) Effective problem-solving and decision-making: (1) Stop the aircraft to check position when in doubt; (2) Assess major risks: collision with other aircraft, obstacles, and aircraft security.

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Transition to instrument flight

Module 1: Pre-flight operations and general handling	
Transition to instrument flight (must be performed by sole reference to instruments)	
OBJECTIVE	Establish the climb, complete a smooth transition to instrument flight, and complete post-take-off checks and drills.
SKILL	Following the initial take-off procedure: (A) Compare the visual attitude achieved with the attitude indicator display; (B) Assess the performance instrument information to confirm that the aircraft has achieved the desired climb parameters; (C) Commence appropriate instrument scanning techniques.
KNOWLEDGE	(A) Demonstrate the required technical knowledge of the function of the instruments in order to safely fly the aircraft by sole reference to instruments. (B) Understand the need to compare the attitude indicator with the real world. (C) Understand the need to verify that the expected performance has been achieved.
ATTITUDE	(A) Situation awareness: Monitor aircraft flight path at all stages of the transition to instrument flight. (B) Effective communication: Demonstrate effective communication (as applicable). (C) Leadership and teamwork: Demonstrate effective coordination (as applicable). (D) Effective problem-solving and decision-making: (1) Correctly assess take-off and climb hazards, particularly those related to other aircraft, aerodrome infrastructure, obstacles, and weather; (2) Have a strategy to mitigate the threats.

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ATC liaison — compliance, radio-telephony (RTF) procedures

Module 1: Pre-flight operations and general handling	
ATC liaison — compliance, radio-telephony (RTF) procedures (must be performed by sole reference to instruments)	
OBJECTIVE	(A) Ability to communicate clearly with ATC using appropriate RTF phraseology in order to perform the flight as planned in compliance with ATC instructions. (B) In the event of changes to the plan, such changes should be negotiated with ATC to ensure continued compliance.
SKILL	(A) ICAO language proficiency level 4 or greater. (B) The ability to use standard and, where applicable, non-standard RTF procedures. (C) Understand the implications of the received clearance, and be able to action the same safely and effectively. (D) Interpretation of charts and maps.
KNOWLEDGE	(A) Specific ATC phrases, e.g. ETA vs EAT. (B) Aircraft category for instrument approaches. (C) Performance of the aircraft and its ability to meet the ATC clearance. (D) ICAO standard phraseology and national differences. (E) Pilot or controller responsibilities including tower, en-route, and appropriate clearances. (F) Adequate knowledge of RTF failure procedures.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times. (B) Effective communication: Read back correctly, in a timely manner, the ATC clearance in the sequence received. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Copy correctly, in a timely manner, the ATC clearance as issued. (E) Effective problem-solving and decision-making: Interpret correctly the ATC clearance received and, when necessary, request clarification, verification, or change.

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Control of the aeroplane by reference solely to instruments, including: level flight at various speeds, level turns at rate 1 and up to 30 degrees angle of bank, trim

Module 1: Pre-flight operations and general handling (must be performed by sole reference to instruments)	
Control of the aeroplane by reference solely to instruments, including: level flight at various speeds, level turns at rate 1 and up to 30 degrees angle of bank, trim	
OBJECTIVE	(A) Smooth control of heading, altitude, speed, power, trim and ancillary controls. (B) Correct use of autopilot, where appropriate. (C) Demonstrate correct technique for instrument flight manoeuvring within specified limits. (D) Maintain balanced and trimmed flight.
SKILL	(A) Maintain altitude, heading and balance, by sole reference to instruments, using correct instrument confirmation, and coordinated control application. (B) Maintain altitude, heading and balance, whilst accelerating or decelerating to specific speeds, as determined by the aircraft flight manual, or as specified by the examiner. (C) Complete coordinated level turns at rate 1 and maintain entry speed onto specified headings. (D) Complete coordinated level turns at up to 30 degrees bank whilst maintaining entry speed onto specified headings. (E) Demonstrate correct procedure for pre-flight functional check of autopilot or flight director. (F) Demonstrate correct operating procedure for autopilot or flight director in all modes.
KNOWLEDGE	(A) Procedures for controlling the aircraft in accordance with the POM, aircraft flight manual and operations manual, as appropriate. (B) Autopilot system fitted to the aircraft. (C) Procedures for controlling the aircraft with automatic flight control systems, in accordance with the POM, aircraft flight manual and operations manual, as appropriate.
ATTITUDE	(A) Situation awareness: (1) Maintain awareness of the autopilot modes selected, where applicable; (2) Understand the need for trimmed, in-balance flight when manually flying the aircraft. (B) Effective communication: As applicable to the specific situation. (C) Leadership and teamwork: As applicable to the specific situation. (D) Effective workload management: Use an appropriate ‘division of attention’ when completing flight log, etc., whilst manually controlling the aircraft. (E) Effective problem-solving and decision-making: Prioritise activities to allow maintenance of correct instrument scan.

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Climbing and descending turns with sustained rate-1 turn

Module 1: Pre-flight operations and general handling (must be performed by sole reference to instruments)	
Climbing and descending turns with sustained rate-1 turn	
OBJECTIVE	Complete a coordinated climb or descent and turn at rate 1 using: (A) the recommended climbing speed; or (B) descent speed and nominated rates of descent for the aircraft.
SKILL	(A) Establish the recommended entry airspeed in straight and level flight. (B) Roll into a coordinated climbing or descending turn with a bank angle commensurate with the speed to produce a rate-1 turn. Maintain the bank angle in a stable, balanced turn. (C) Apply smooth, coordinated pitch, bank, and power adjustments to maintain the specified attitude and airspeed. (D) Roll out of the turn and stabilise the aircraft in straight and level flight. (E) Recover accurately onto the desired heading and at the desired airspeed for straight and level flight.
KNOWLEDGE	(A) Speed and bank angle relationship to establish a rate-1 turn. (B) Recommended climb speed and power settings. (C) Recommended speed and power settings for descent at nominated descent rates.
ATTITUDE	(A) Effective workload management: Demonstrate orientation throughout the manoeuvre. (B) Effective problem-solving and decision-making: React to departure from stabilised steep turn attitude.

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Recovery from approach to stall in level flight, climbing/descending turns and in landing configuration

Module 1: Pre-flight operations and general handling (must be performed by sole reference to instruments)	
Recovery from approach to stall in level flight, climbing/descending turns and in landing configuration (may be performed in an FSTD, if approved for this procedure)	
OBJECTIVE	(A) Demonstrate how to conduct appropriate safety checks before stalling. (B) Establish the required aircraft configuration and stall entry, as appropriate, from straight and level or manoeuvring flight. (C) Maintain heading (or 10–30° bank angle, as required) to stall entry. (D) Recognise the symptoms of stall or approaching stall, and initiate the correct recovery action. (E) Recover, using the correct techniques, to return to a clean configuration best rate climb, or as otherwise directed by the examiner. (F) Complete all the necessary checks and drills.
SKILL	(A) Select an entry altitude in accordance with safety requirements. When accomplished in an FSTD, the entry altitude may be at low, intermediate or high altitude as appropriate for the aircraft and the configuration. (B) Slowly establish the pitch attitude (using trim, elevator or stabiliser), bank angle, and power setting that will induce stall at the desired target airspeed. Normal trim should be used as the aircraft speed reduces, with trim at different, or as stated in the flight manual restrictions. (C) Recognise and announce the first indication of a stall appropriate to the specific aircraft design and initiate recovery. (D) Recover to a reference airspeed, altitude and heading, allowing only the acceptable altitude or airspeed loss and heading deviation using the procedures described in the aircraft flight manual or operator safety manual, as applicable. (E) Demonstrate smooth, positive control during entry, approach to a stall, and recovery.
KNOWLEDGE	(A) Academic knowledge. (B) Limitations. (C) Safety procedures before starting with stall exercises. (D) Stall recovery procedures and techniques. (E) Flight manual. (F) Operator safety manual.
ATTITUDE	(A) Situation awareness: Ensure the aircraft is in a safe area and clear of hazards prior to accomplishing an approach to a stall. (B) Effective communication: Communicate and coordinate. (C) Leadership and teamwork: Coordinate to ensure that there is adequate separation from other aircraft before initiating the stall. (D) Effective workload management: As applicable to the specific situation. (E) Effective problem-solving and decision-making: As applicable to the specific situation.

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Limited panel instrument flight: stabilised climb or descent, level turns at rate 1 onto given headings, recovery from unusual attitudes

Module 1: Pre-flight operations and general handling (must be performed by sole reference to instruments)	
Limited panel instrument flight: stabilised climb or descent, level turns at rate 1 onto given headings, recovery from unusual attitudes — only applicable to aeroplanes	
NB: Most modern light aircraft are now fitted with a 'standby' horizon in addition to or instead of turn rate gyros. Where this is the case, the pilot under training is to be taught these exercises using the 'standby' horizon.	
OBJECTIVE	Demonstrate continued control of the aircraft by interpreting aircraft attitude from aircraft standby instruments.
SKILL	(A) Complete flight in straight and level, and climbing and descending, at nominated speeds. Fly turns at rate 1 onto nominated headings using the correct technique and demonstrating correct instrument scan and interpretation. (B) Recover from unusual attitudes including sustained 45° bank turns and steep descending and climbing turns using the correct technique to minimise height loss.
KNOWLEDGE	(A) Demonstrate the theoretical knowledge and understand the dangers of 'looping error'. (B) Variation of techniques. (C) Limitations of the use of direct-reading compass systems.
ATTITUDE	(A) Situation awareness: (1) recognition of the reason behind the unusual attitude; (2) after recovery: why did the aircraft enter the unusual attitude, e.g. distraction, instrument failure, mishandling, etc.? (3) after recovery: is the aircraft above safety altitude? (4) which is a safe direction to fly whilst assessing the situation? (B) Effective workload management: Address the situation to recover situation awareness. (C) Effective communication: Advise ATC if appropriate. (D) Leadership and teamwork: Communicate and coordinate as appropriate. (E) Effective problem-solving and decision-making: React promptly to departure from controlled flight.

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(2) Module 2: Departure, precision (3D) approach procedures and non-precision (2D) approach procedures

Weather minima

Module 2: Departure and arrivals, 3D approach and 2D approach Weather minima	
OBJECTIVE	Confirmation of weather affecting departure, route, destination and diversion; acceptability for the flight. Determination of the expected instrument approach minimum heights/altitudes in accordance with NCO requirements.
SKILL	Ability to interpret published weather charts such as synoptic charts and coded messages (TAF, METAR, SNOWTAM, etc.).
KNOWLEDGE	(A) Air masses and local weather effects. (B) Weather codes. (C) NCO requirements.
ATTITUDE	(A) Situation awareness: (1) Be able to interpret and understand the weather factors and all the associated potential hazards likely to affect the planned flight; (2) Assess correctly whether the weather minima required at destination and diversion airfields are satisfactory for the conduct of the flight. (B) Effective communication: As applicable to the specific situation. (C) Leadership and teamwork: As applicable to the specific situation. (D) Effective workload management: As applicable to the specific situation. (E) Effective problem-solving and decision-making: Make appropriate decisions based on available weather information.

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Pre-take-off briefing, take-off

Module 2: Departure and arrivals, 3D approach and 2D approach Pre-take-off briefing, take-off	
OBJECTIVE	(A) Perform a safe take-off in compliance with ATC clearance, procedure margins and within the flight manual limits taking into account environmental conditions. (B) Obtain ATC clearance for departure, flight deck preparation, confirmation of departure, and passenger emergency briefing. Actions to be taken with regard to the aeroplane if an emergency occurs during departure should be covered in the pre-flight main briefing.
SKILL	(A) Obtain appropriate take-off clearance using standard RTF phraseology, and perform all required pre-take-off checks (including visually scanning for other aircraft). (B) Position the aircraft correctly for take-off taking into account any crosswind condition. (C) Apply the controls correctly to maintain longitudinal alignment on the centre line of the runway prior to initiating and during the take-off. (D) Set the throttle(s) to take-off power with appropriate checks (e.g. verify the expected engine performance, monitor engine controls, settings and instruments during take-off to ensure all predetermined parameters are maintained). (E) Use the correct take-off technique by applying recommended speeds for rotation, lift-off and initial climb. (F) Adjust the controls to attain the desired pitch attitude at the predetermined airspeed to obtain the desired performance. (G) Ensure a safe climb and departure in accordance with clearance and with due regard for other air traffic, noise abatement and wake turbulence avoidance procedures, adjusting power and aircraft configuration, and maintain desired path (or heading) as appropriate. (H) Complete all necessary post-take-off checks. (I) Perform or call for and verify the accomplishment of landing gear and flap retractions, power adjustments, and other required pilot-related activities at the required airspeeds within the tolerances established in the flight manual.
KNOWLEDGE	(A) Limitations, procedure margins. (B) Normal procedures (understand the different techniques dependent on varying flap settings and environmental conditions). (C) Abnormal and emergency procedures. (D) Performance. (E) Applicable rules on wake turbulence separation.
ATTITUDE	(A) Situation awareness: (1) Monitor engine parameters for any deviations; (2) Monitor aircraft acceleration during take-off; (3) Monitor aircraft ground and flight path at all stages of the take-off procedure. (B) Effective communication: Demonstrate effective communication with ATC (as applicable). (C) Leadership and teamwork: Demonstrate effective coordination with ATC (as applicable). (D) Effective problem-solving and decision-making: Correctly assess take-off and climb hazards, particularly those related to other aircraft, aerodrome infrastructure, obstacles and weather, and have a strategy to mitigate the threats.

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Instrument departure procedures, altimeter setting

Module 2: Departure and arrivals, 3D approach and 2D approach	
Instrument departure procedures, altimeter setting (must be performed by sole reference to instruments)	
OBJECTIVE	Complete the standard instrument departure (SID) procedure or follow the ATC departure instructions; use the correct altimeter-setting procedure; maintain aeroplane control, speed, heading and level.
SKILL	(A) Identify any navigation aids used. (B) Follow any noise routing or departure procedures and ATC clearances. (C) Take appropriate anti-icing/de-icing actions. (D) Use the current and appropriate navigation publications for the proposed departure. (E) Make correct use of instruments, flight director, autopilot, navigation equipment and communication equipment appropriate to the performance of the departure. (F) Intercept and follow, in a timely manner, all courses, radials and bearings (QDM/QDRs) appropriate to the departure route and ATC clearance. (G) Comply, in a timely manner, with all ATC clearances, instructions and restrictions. (H) Perform the aircraft briefing or checklist items appropriate to the departure. (I) Adhere to airspeed restrictions and adjustments required by regulations, ATC and the flight manual. (J) Maintain the appropriate airspeed, altitude, headings and accurately track radials, courses, and bearing. (K) Complete the appropriate checklist
KNOWLEDGE	(A) Weather phenomena, particularly the conditions favouring the formation of ice on the airframe and engines. (B) Limitations of the use of ground-based navigation aids. (C) Limitations of the use of RNAV (GNSS) derived navigational information. (D) Division of airspace and altimeter-setting procedures associated with the current airspace environment. (E) The departure procedure in use and the safety implications of not adhering to the procedure. (F) Altimetry procedures in accordance with the applicable regulations.
ATTITUDE	(A) Situation awareness: (1) Understanding of any clearance limits or variations to SID/initial departure clearance instructed by ATC; (2) Awareness of the aircraft performance and the ability to conform to ATC clearances (speed, height, time limits, etc.). (B) Effective communication: Demonstrate correct communication with ATC (where applicable). (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Prioritise attention properly between aircraft control, navigation and communication tasks. (E) Effective problem-solving and decision-making: Make the necessary decisions to mitigate the effect of changing conditions that may affect aircraft (weather, navigation aid serviceability, ATC, etc.).

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Holding procedure

Common to both 3D and 2D procedures (must be performed by sole reference to instruments)	
Holding procedure	
OBJECTIVE	Complete the appropriate entry procedure followed by a standard ICAO holding fix, using information in order to maintain the protected area.
SKILL	(A) Make appropriate adjustments in order to arrive over the holding fix as close as possible to the 'expected approach time', if required. (B) Recognise arrival at the clearance limit or holding fix. (C) Comply with ATC reporting requirements. (D) Change to the recommended holding airspeed appropriate for the aircraft and holding altitude, so as to cross the holding fix at or below the maximum holding airspeed. (E) Follow the appropriate entry procedures in accordance with standard operational procedures or as required by ATC. (F) Use the correct timing criteria where required by the holding procedure or ATC. (G) Use wind-drift correction techniques accurately to maintain the appropriate joining and holding pattern and to establish and maintain the correct tracks and bearings. (H) Maintain the appropriate airspeed, altitude and headings accurately to establish and maintain the correct tracks and bearings. (I) Make appropriate adjustments to the procedure timing to allow for the effects of known wind.
KNOWLEDGE	(A) Holding endurance, including but not necessarily limited to fuel on board. (B) Fuel flow while holding. (C) Fuel required to alternate, etc.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the cleared holding pattern. (E) Effective problem-solving and decision-making: React to navigation errors or unexpected systems malfunctions.

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Setting and checking of navigation aids, identification of facilities

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Setting and checking of navigation aids, identification of facilities	
OBJECTIVE	(A) Use of navigation aids with regard to promulgated range, identification and interpretation. (B) Use the RAIM prediction, if applicable. (C) Use the correct RNP approach specifications (LPV, LNAV/VNAV).
SKILL	(A) Set and identify relevant navigation aids. (B) Confirm the availability and serviceability of selected navigation equipment.
KNOWLEDGE	(A) Systems: communication, navigation and auto-flight systems. (B) RNP approach specifications (LPV, LNAV/VNAV).
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Select radio aids appropriate to the intended approach; (3) PBN limitations; (4) Temperature limitations (LNAV/VNAV). (B) Effective workload management: Monitor to ensure safe flight profile whilst selecting and checking radio aids. (C) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (D) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

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Arrival procedures, altimeter checks

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Arrival procedures, altimeter checks	
OBJECTIVE	Descent planning and consideration of minimum sector altitude (MSA) or terminal arrival altitude (TAA). Completion of the published arrival procedure or as instructed by ATC, including altimeter setting or protected area, ATC liaison and RTF procedures.
SKILL	(A) Set and cross-check the appropriate altimeter settings. (B) Use the correct RTF procedures and terminology and comply with all ATC instructions and clearances. (C) Establish the appropriate aircraft configuration and airspeed for the phase of the approach. (D) Comply with the published arrival procedure or as required by ATC. (E) Interpretation of arrival charts.
KNOWLEDGE	(A) Altimetry procedures in accordance with the applicable regulations. (B) Knowledge of legends used in the approach charts. (C) Understanding of ATC procedures and RTF phraseology for the type of approach to be completed. (D) Knowledge of RNP arrival procedure.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC, as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: react to deviation errors or unexpected systems malfunctions.

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Approach and landing briefing, including descent, approach, landing checks and missed approach

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Approach and landing briefing, including descent, approach, landing checks and missed approach	
OBJECTIVE	The approach briefing including weather and confirmation of instrument approach procedure minima, and applicable procedures.
SKILL	(A) Complete the checks for landing and configure the aircraft appropriately. (B) Complete a short self-briefing with regard to arrival, holding, approach, minima, weather conditions, associated performances, taxiing and missed approach procedure.
KNOWLEDGE	(A) Use of checklist as appropriate. (B) Determination of approach minima. (C) Make the necessary adjustments to the published approach minima criteria for the aircraft approach category, and with due regard for: (1) NOTAMs; (2) inoperative navigation equipment; (3) inoperative visual aids associated with the landing environment; (4) reported weather conditions; (5) aircraft status (effects of any inoperative systems).
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Aircraft technical status. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

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Compliance with published approach procedure

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Compliance with published approach procedure	
OBJECTIVE	(A) Compliance with the published 3D approach procedure. (B) Vertical and horizontal profile to the nominated minima in accordance with protected areas.
SKILL	(A) Manage the appropriate source of navigation system. (B) Complete the manoeuvring pattern as required to establish the final approach segment within the specified flight tolerances. (C) Establish a predetermined rate of descent at the point where the glide path begins, in order to follow the glide path. (D) Intercept and track within the prescribed limits. (E) Interpretation of approach chart.
KNOWLEDGE	(A) Systems: communication, navigation and auto-flight systems. (B) Correctly interpret and understand the procedure to be flown from the approach chart for runway and procedure in use. (C) Autopilot and flight director limitations. (D) Software and capacity system.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times; (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the cleared procedure. (E) Effective problem-solving and decision-making: React to navigation errors or unexpected systems malfunctions.

BRUNEI DCA

Altitude, speed, heading control (stabilised approach)

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Altitude, speed, heading control (stabilised approach)	
OBJECTIVE	(A) Establish a stabilised approach, in trim for the aeroplane configuration and speed, using the correct techniques for attitude, heading and power control. (B) Correct assessment of track and vertical path.
SKILL	(A) Establish the final approach and maintain the approach path in horizontal and vertical profile to minima. (B) Control the aircraft as necessary to achieve a stable approach path. (C) Arrive at the minima on a stabilised approach in order to make a correct decision to perform a landing, go-around or circling approach safely. (D) Prepare backup radio aids for continued approach in the event of radio aid or display equipment failure. (E) Use correct RTF procedures and terminology and comply with all ATC instructions and clearances.
KNOWLEDGE	(A) Horizontal and vertical tolerances. (B) Actions to be taken in the event of radio aid or display equipment failure. (C) Procedure in the event of loss of communication with ATC. (D) Procedure in the event of loss of integrity.
ATTITUDE	(A) Situation awareness: Confirm that approach is stabilised. (B) Effective communication: Advise ATC if appropriate. (C) Leadership and teamwork: (1) Demonstrate correct coordination with ATC (where applicable); (2) Procedures for loss of approach capability. (D) Effective workload management: Monitor to ensure that the flight profile remains safe. (E) Effective problem-solving and decision-making: Make appropriate decision to abandon approach if required.

BRUNEI DCA

Setting and checking of navigation aids, identification of facilities

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Setting and checking of navigation aids, identification of facilities	
OBJECTIVE	(A) Use of navigation aids with regard to promulgated range, identification and interpretation. (B) Use the RAIM prediction, if applicable. (C) Use the correct RNP approach specifications. (D) Calculate the true altitude as required.
SKILL	(A) Set and identify relevant navigation aids. (B) Confirm the availability and serviceability of selected navigation equipment.
KNOWLWDGE	(A) Systems: communication, navigation and auto-flight systems. (B) RNP approach specifications (LNAV). (C) True altitude corrections for temperature.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Select radio aids appropriate to the intended approach. (B) Effective workload management: Monitor to ensure safe flight profile whilst selecting and checking radio aids. (C) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (D) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Arrival procedures, altimeter checks

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Arrival procedures, altimeter checks	
OBJECTIVE	(A) Descent planning and consideration of MSA or TAA. (B) Completion of the published arrival procedure or as instructed by ATC, including altimeter setting or protected area, ATC liaison and RTF procedures.
SKILL	(A) Set and cross-check the appropriate altimeter settings. (B) Use the correct RTF procedures and terminology and comply with all ATC instructions and clearances. (C) Establish the appropriate aircraft configuration and airspeed for the phase of the approach. (D) Comply with the published arrival procedure or as required by ATC. (E) Interpretation of arrival charts.
KNOWLEDGE	(A) Altimetry procedures, in accordance with the applicable regulations. (B) Knowledge of the legends used in the approach charts. (C) Understanding of ATC procedures and RTF phraseology for the type of approach to be completed. (D) Knowledge of RNP arrival procedure.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) PBN protected area. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Approach and landing briefing, including descent, approach, landing checks and missed approach

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Approach and landing briefing, including descent, approach, landing checks and missed approach	
OBJECTIVE	The approach briefing including weather and confirmation of instrument approach procedure minima, and applicable procedures.
SKILL	(A) Complete the checks for landing and configure the aircraft appropriately. (B) Complete a short self-briefing with regard to arrival, holding, approach, minima, weather conditions, associated performances, taxiing and missed approach procedure.
KNOWLEDGE	(A) Use of checklist as appropriate. (B) Determination of approach minima. (C) Make the necessary adjustments to the published approach minima criteria for the aircraft approach category, and with due regard for: (1) NOTAMs; (2) inoperative navigation equipment; (3) inoperative visual aids associated with the landing environment; (4) reported weather conditions; (5) aircraft status (effects of any inoperative systems).
ATTITUDES	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Aircraft technical status. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Compliance with published approach procedure

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Compliance with published approach procedure	
OBJECTIVE	(A) Compliance with the published 3D approach procedure. (B) Vertical and horizontal profile to the nominated minima in accordance with protected areas.
SKILL	(A) Manage the appropriate source of navigation system. (B) Complete the manoeuvring pattern as required to establish the final approach segment within the specified flight tolerances. (C) Establish a predetermined rate of descent at the point where the glide path begins, in order to follow the glide path. (D) Intercept and track within the prescribed limits. (E) Interpretation of approach chart.
KNOWLEDGE	(A) Systems: communication, navigation and auto-flight systems. (B) Correctly interpret and understand the procedure to be flown from the approach chart for runway and procedure in use. (C) Autopilot and flight director limitations. (D) Software and capacity system.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times; (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the cleared procedure. (E) Effective problem-solving and decision-making: React to navigation errors or unexpected systems malfunctions.

BRUNEI DCA

Altitude, speed, heading control (stabilised approach)

Module 2: 3D approach procedures (must be performed by sole reference to instruments)	
Altitude, speed, heading control (stabilised approach)	
OBJECTIVE	(A) Establish a stabilised approach, in trim for the aeroplane configuration and speed, using the correct techniques for attitude, heading and power control. (B) Correct assessment of track and vertical path.
SKILL	(A) Establish the final approach and maintain the approach path in horizontal and vertical profile to minima. (B) Control the aircraft as necessary to achieve a stable approach path. (C) Arrive at the minima on a stabilised approach in order to make a correct decision to perform a landing, go-around or circling approach safely. (D) Prepare backup radio aids for continued approach in the event of radio aid or display equipment failure. (E) Use correct RTF procedures and terminology and comply with all ATC instructions and clearances.
KNOWLEDGE	(A) Horizontal and vertical tolerances. (B) Actions to be taken in the event of radio aid or display equipment failure. (C) Procedure in the event of loss of communication with ATC. (D) Procedure in the event of loss of integrity.
ATTITUDE	(A) Situation awareness: Confirm that approach is stabilised. (B) Effective communication: Advise ATC if appropriate. (C) Leadership and teamwork: (1) Demonstrate correct coordination with ATC (where applicable); (2) Procedures for loss of approach capability. (D) Effective workload management: Monitor to ensure that the flight profile remains safe. (E) Effective problem-solving and decision-making: Make appropriate decision to abandon approach if required.

BRUNEI DCA

Setting and checking of navigation aids, identification of facilities

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Setting and checking of navigation aids, identification of facilities	
OBJECTIVE	(A) Use of navigation aids with regard to promulgated range, identification and interpretation. (B) Use the RAIM prediction, if applicable. (C) Use the correct RNP approach specifications. (D) Calculate the true altitude as required.
SKILL	(A) Set and identify relevant navigation aids. (B) Confirm the availability and serviceability of selected navigation equipment.
KNOWLEDGE	(A) Systems: communication, navigation and auto-flight systems. (B) RNP approach specifications (LNAV). (C) True altitude corrections for temperature.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Select radio aids appropriate to the intended approach. (B) Effective workload management: Monitor to ensure safe flight profile whilst selecting and checking radio aids. (C) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (D) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Arrival procedures, altimeter checks

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Arrival procedures, altimeter checks	
OBJECTIVE	(A) Descent planning and consideration of MSA or TAA. (B) Completion of the published arrival procedure or as instructed by ATC, including altimeter setting or protected area, ATC liaison and RTF procedures.
SKILL	(A) Set and cross-check the appropriate altimeter settings. (B) Use the correct RTF procedures and terminology and comply with all ATC instructions and clearances. (C) Establish the appropriate aircraft configuration and airspeed for the phase of the approach. (D) Comply with the published arrival procedure or as required by ATC. (E) Interpretation of arrival charts.
KNOWLEDGE	(A) Altimetry procedures, in accordance with the applicable regulations. (B) Knowledge of the legends used in the approach charts. (C) Understanding of ATC procedures and RTF phraseology for the type of approach to be completed. (D) Knowledge of RNP arrival procedure.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) PBN protected area. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Approach and landing briefing, including descent, approach, landing checks and missed approach

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Approach and landing briefing, including descent, approach, landing checks and missed approach	
OBJECTIVE	The approach briefing including weather and confirmation of instrument approach procedure minima, and applicable procedures.
SKILL	(A) Complete the landing and configure the aircraft as appropriate. (B) Complete a short self-briefing with regard to arrival, holding, approach, minima, weather conditions, associated performances, taxiing and missed approach procedure.
KNOWLEDGE	(A) Use of checklist as appropriate. (B) Determination of approach minima. (C) Adjustments necessary to the published approach minima criteria for the aircraft approach category, and with due regard for: (1) NOTAMs; (2) inoperative navigation equipment; (3) inoperative visual aids associated with the landing environment; (4) reported weather conditions.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Aircraft technical status. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

Compliance with published approach procedure

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Compliance with published 2D approach procedure	
OBJECTIVE	(A) Compliance with the published approach procedure. (B) Vertical and horizontal profile to the nominated minima in accordance with protected areas. (C) Use of the CDFA technique where appropriate.
SKILL	(A) Manage the appropriate source of navigation system. (B) Select and comply with the appropriate 2D instrument approach procedure. (C) Complete the manoeuvring pattern as required to establish the final approach segment within the specified flight tolerances and protected area. (D) Establish a predetermined rate of descent in order to follow the published path. (E) Intercept and track the final approach track within the prescribed limits. (F) Interpretation of approach chart. (G) Ability to interpret deviation. (H) Correct selection of navigation input to the display.
KNOWLEDGE	(A) Systems: communication, navigation and auto-flight systems. (B) Correctly interpret and understand the procedure to be flown from the approach chart for runway and procedure in use. (C) CDFA technique where appropriate. (D) Autopilot and flight director limitations.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times; (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the cleared procedure. (E) Effective problem-solving and decision-making; React to navigation errors or unexpected systems malfunctions.

BRUNEI DCA

Altitude, speed and heading control (stabilised approach)

Module 2: 2D approach procedures (must be performed by sole reference to instruments)	
Altitude, speed and heading control (stabilised approach)	
OBJECTIVE	(A) Establish a stabilised approach, in trim for the aeroplane configuration and speed, using the correct techniques for attitude, heading and power control. (B) Correct assessment of track and rate of descent or vertical path angle.
SKILL	A) Establish the final approach and maintain the approach path in horizontal and vertical profile to minima. (B) Control the aircraft as necessary to achieve a stable final approach. (C) Arrive at the minima on a stabilised approach in order to make a correct decision to perform a landing, go-around or circling approach safely. (D) Prepare backup radio aids for continued approach in the event of radio aid or display equipment failure. (E) Use correct RTF procedures and terminology, and comply with all ATC instructions and clearances.
KNOWLEDGE	(A) Horizontal and vertical tolerances. (B) Actions to be taken in the event of radio aid/display equipment failure. (C) Procedure in the event of loss of communication with ATC. (D) Procedure in the event of loss of integrity.
ATTITUDE	(A) Situation awareness: Confirm that the approach is stabilised. (B) Effective communication: Advise ATC if appropriate. (C) Leadership and teamwork: (1) Demonstrate correct coordination with ATC (where applicable); (2) Procedures for loss-of-approach capability. (D) Effective workload management: Monitor to ensure that the flight profile remains safe. (E) Effective problem-solving and decision-making: Make appropriate decision to abandon approach if required.

BRUNEI DCA

Approach timing

Module 2: Specificities of conventional 2D approach procedures (must be performed by sole reference to instruments)	
Approach timing	
OBJECTIVE	Monitor or control the approach procedure using timing as necessary.
SKILL	Where DME information from ground-based beacons (VOR or NDB) or marker is not available, the applicant makes appropriate adjustments to the procedure timing to allow for the effects of known wind.
KNOWLEDGE	(A) Use of wind-effect correction techniques. (B) Use of wind-drift correction techniques to maintain the correct tracks, bearings and approximate distances.
ATTITUDE	(A) Situation awareness: (1) Understand when approach timing techniques are required; (2) Understand the impact required on the descent technique for the intermediate approach phase. (B) Effective workload management: Use an appropriate 'division of attention' whilst controlling the aircraft in order to apply wind-corrected timing. (C) Effective communication: As applicable to the specific situation. (D) Leadership and teamwork: As applicable to the specific situation. (E) Effective problem-solving and decision-making: As applicable to the specific situation.

BRUNEI DCA

Go-around and missed approach action

Module 2: Common to both 3D and 2D procedures (must be performed by sole reference to instruments)	
Go-around and missed approach action	
OBJECTIVE	Make a smooth transition to a climb at the correct speed and complete the checks when: (1) reaching the minima; (2) directed by ATC; (3) being in an unstabilised approach; (4) experiencing a loss of integrity; or (5) any other reasons affecting safety approach.
SKILL	(A) Initiate go-around action in case of unstabilised approach or loss of integrity. (B) Initiate go-around action at or above minima if safe landing is not possible. (C) Control the aircraft as necessary to achieve a stable and trimmed initial climb profile. (D) Ensure a safe climb and departure in accordance with ATC clearance and with due regard for other air traffic, noise abatement and wake turbulence avoidance procedures adjusting power and aircraft configuration, and maintain desired path (or heading) as appropriate. (E) Complete all necessary procedures and checks. (F) Select the missed approach if available.
KNOWLEDGE	(A) Go-around procedure. (B) Aircraft limitations for landing gear retraction, flap retraction and power plant. (C) Necessary RTF procedures. (D) Performance limitation. (E) Climb gradient. (F) Protected areas. (G) RNP approach specifications.
ATTITUDE	(A) Situation awareness: Monitor aircraft flight path at all stages of the go-around. (B) Effective communication: (1) Demonstrate effective communication (as applicable); (2) Communicate with ATC when safe to do so. (C) Leadership and teamwork: Demonstrate effective coordination with ATC (as applicable). (D) Effective problem-solving and decision-making: Correctly assess go-around and climb hazards, particularly those related to other aircraft, aerodrome infrastructure, obstacles and weather, and have a strategy to mitigate the threats.

BRUNEI DCA

Landing

Module 2: Common to both 3D and 2D procedures (must be performed by sole reference to instruments)	
Landing	
OBJECTIVE	(A) Visual landing or circle for landing, as appropriate, in a safe and controlled manner. (B) Define a strategy for track management in case of missed approach or go-around in the circle to land.
SKILL	Landing: (A) acquire the required visual references and continue to land the aircraft; (B) make a smooth transition from instrument to visual flight; (C) join smoothly, if necessary, the visual approach flight path; (D) maintain a stable (speed, power, heading) approach until the flare; (E) complete post-landing checklist.
KNOWLEDGE	(A) Flight manual. (B) Limitations. (C) Normal procedures: Demonstrate adequate judgement and knowledge of the aircraft performance and systems in order to comply with published approach procedures for the equipment used for the approach.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Controlled flight into terrain (CFIT); (3) Balked landing. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the approach procedure. (E) Effective problem-solving and decision-making: React to deviation errors or unexpected systems malfunctions.

BRUNEI DCA

ATC liaison — compliance, RTF procedures

Module 2: Common to both 3D and 2D procedures (must be performed by sole reference to instruments)	
ATC liaison — compliance, RTF procedures	
OBJECTIVE	(A) Use correct and standard RTF phraseology throughout. (B) Where appropriate, obtain ATC clearances and appropriate level of service. (C) Where required, comply with ATC clearances and instructions.
SKILL	(A) Comply with all ATC instructions and clearances. (B) Use correct RTF for ILS reporting procedure.
KNOWLEDGE	(A) ICAO standard phraseology. (B) Pilot/controller responsibilities to include tower en-route control and clearance. (C) Demonstrate adequate knowledge of two-way communications failure procedures.
ATTITUDE	(A) Situation awareness: Establish communication with ATC on the correct frequencies and at the appropriate times. (B) Effective communication: Read back correctly, in a timely manner, the ATC clearance in the sequence received. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Copy correctly, in a timely manner, the ATC clearance as issued. (E) Effective problem-solving and decision-making: Interpret correctly the ATC clearance received and, when necessary, request clarification, verification, or change.

BRUNEI DCA

(3) Module 3: En-route IFR procedures

Use of air traffic services document and weather document

Module 3: En-route IFR procedures	
Use of air traffic services document and weather document	
OBJECTIVE	(A) Use of the correct documents, including maps. (B) Use of charts and approach procedure plates to prepare flight plan and flight log. (C) Collating and interpreting weather documents to determine the route weather.
SKILL	(A) Ensure all required paperwork is correctly completed prior to the flight. (B) Interpretation of weather charts and coded messages (TAF, METAR, etc.).
KNOWLEDGE	(A) Weather factors that may affect the safe conduct of the flight (thunderstorms, fog, strong winds, gust factor, crosswinds at departure and destination aerodromes, snow, icing, etc.). (B) Type of approach to be flown, how to calculate approach minima from charts, operational limitations of ground-based aids when planning route, ability to interpret SID and STAR charts. (C) Coordination with ATC when submitting flight plan, implications of 'calculated take-off time', etc.
ATTITUDE	(A) Situation awareness: Note potential weather hazards and act accordingly, submit flight plan in good time for planned departure. (B) Effective communication: Communicate with ATC and ground crew to ensure timely start. (C) Leadership and teamwork: Demonstrate correct crew coordination with ATC (where applicable). (D) Effective workload management: Prioritise tasks to produce a safe and effective plan for the conduct of the flight. (E) Effective problem-solving and decision-making: (1) Identify possible defects and threats; (2) Take corrective action.

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Preparation of ATC flight plan and IFR flight plan or log

Module 3: En-route IFR procedures	
Preparation of ATC flight plan and IFR flight plan or log	
OBJECTIVE	Preparation of the ATC IFR flight plan for the route, including any off-airway sectors, and preparation of a full navigation and RTF flight log.
SKILL	(A) Prepare the flight navigation log, update maps and charts, flight plan, and fuel plan. (B) Obtain and assess all elements of the prevailing and forecast weather conditions for the route and evaluate threats (e.g. icing conditions, convection, wind conditions, potential deterioration below minima). (C) Complete an appropriate flight navigation log. (D) Complete the required ATC flight plan(s) and ensure that all required airfields are addressed. (E) Determine that the aeroplane is correctly fuelled, loaded and legal for the flight. (F) Confirm any aeroplane performance criteria and limitations applicable in relation to runway and weather conditions.
KNOWLEDGE	Demonstrate sufficient knowledge of the regulatory requirements relating to instrument flight.
ATTITUDE	(A) Situation awareness: (1) Understand the responsibilities of proper pre-departure planning and preparations; (2) Appropriate threat and error management for the flight (B) Effective communication: Ensure appropriate and clear communication with all ground service personnel (ATC, dispatch, MET). (C) Leadership and teamwork. (D) Effective workload management: Provide sufficient time, and manage the workload for departure procedures (including documentation) to be completed in an efficient manner. (E) Effective problem-solving and decision-making: Make appropriate decisions on all identified threats, and plan and implement suitable mitigation actions.

BRUNEI DCA

Tracking, including interception, e.g. NDB, VOR, RNAV

Module 3: En-route IFR procedures	
Tracking, including interception, e.g. NDB, VOR, RNAV	
OBJECTIVE	(A) Intercept and maintain the route or amended route, including tracking to and from a position derived from NDB or VOR or RNAV (GNSS) using aircraft display. (B) Follow the flight-planned route or any other ATC route requirements within the specified limits. (C) Identify and use navigation systems correctly. (D) Use the correct altimeter setting procedures and show awareness of protected areas.
SKILL	(A) Use the current and appropriate navigation publications for the proposed flight. (B) Intercept, in a timely manner, all courses, radials and bearings appropriate to the procedure, route, and ATC clearance. (C) Comply, in a timely manner, with all ATC clearances, instructions and restrictions. (D) Perform the aircraft briefing or checklist items appropriate to the arrival. (E) Adhere to airspeed restrictions and adjustments required by regulations, ATC and aircraft flight manual. (F) Maintain the appropriate airspeed, altitude and heading, and accurately track radials, courses and bearing (QDM/QDRs).
KNOWLEDGE	(A) Basic instrument rating knowledge. (B) Proper ATC phraseology. (C) Demonstrate adequate knowledge of: (1) flight manual; (2) limitations; (3) instrument patterns; (4) two-way communications failure procedures. (D) Systems: communication, navigation and auto-flight systems. (E) PBN specifications.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Awareness of aircraft position in space. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Communicate with ATC as appropriate. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Monitor to ensure that the flight profile complies with the cleared en-route routing. (E) Effective problem-solving and decision-making: React to navigation errors or unexpected systems malfunctions.

BRUNEI DCA

Use of radio aids

Module 3: En-route IFR procedures (must be performed by sole reference to instruments)	
Use of radio aids	
OBJECTIVE	(A) Correct use of RNAV system and radio aids with regard to promulgated range, identification and interpretation. (B) Use of ATIS/VOLMET where available.
SKILL	(A) Use the current and appropriate navigation publications for the proposed flight. (B) Select a combination of radio aids that allow the aircraft position to be correctly determined. (C) Manage the display of such aids so that the navigational information is readily available. (D) Correctly identify the chosen radio aids using Morse code where appropriate, i.e. when there is no 'auto-ident'. (E) Correctly assess the functionality of radio aids, including RNAV, before using them for navigation. (F) Correctly check receiver autonomous integrity monitoring (RAIM) of GNSS systems, if applicable. (G) Correctly input navigation planning data into the GNSS system where appropriate.
KNOWLEDGE	(A) Demonstrate the theoretical knowledge and understanding of: (1) the limitations and errors of VOR and NDB, the limitations and errors of VOR and NDB receivers in the aircraft, and the resulting potential navigational error; (2) information pertinent to radio aids or RNAV operations contained in NOTAMs; (3) correct identification of ground-based radio aids; (4) the radio aid equipment and associated displays fitted to the aircraft. (B) Identify when a ground-based radio aid is radiating but the signal is not available for navigation.
ATTITUDE	(A) Situation awareness: (1) Monitor flight progress and select the appropriate navigation systems to enable successful completion of the planned route; (2) Awareness of aircraft position in space. (B) Effective communication: As applicable to the specific situation. (C) Leadership and teamwork: As applicable to the specific situation. (D) Effective workload management: Use an appropriate 'division of attention' appropriately whilst controlling the aircraft and reset navigation aids. (E) Effective problem-solving and decision-making: React to navigation errors or unexpected systems malfunctions.

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Level flight, control of heading, attitude and airspeed, power-setting, trim technique

Module 3: En-route IFR procedures	
Level flight, control of heading, attitude and airspeed, power-setting, trim technique	
OBJECTIVE	(A) Smooth control of heading, attitude and airspeed, power, trim and ancillary controls. (B) Correct use of autopilot where appropriate. (C) Demonstrate correct technique for instrument flight manoeuvring within specified limits. (D) Maintain balanced and trimmed flight.
SKILL	(A) Maintain altitude, heading and balance, by sole reference to instruments, using correct instrument confirmation, and coordinated control application. (B) Maintain altitude, heading and balance, whilst accelerating or decelerating to specific speeds, as determined by the aircraft flight manual. (C) Demonstrate correct procedure for pre-flight functional check of autopilot, flight director and aircraft navigation system, as applicable. (D) Demonstrate correct operating procedure for aircraft navigation systems, autopilot or flight director in all modes.
KNOWLEDGE	(A) Procedures for controlling the aircraft in accordance with the aircraft flight manual and flight manual, as appropriate. (B) Autopilot, flight director and navigation system fitted to the aircraft.
ATTITUDE	(A) Situation awareness: (1) Maintain awareness of the autopilot modes selected, where applicable; (2) Understand the need for trimmed, in-balance flight when manually flying the aircraft; (3) Maintain adequate scan rate before, during and after execution of any manoeuvre by reference to instruments and autopilot performance. (B) Effective communication: As applicable to the specific situation. (C) Leadership and teamwork: As applicable to the specific situation. (D) Effective workload management: Use an appropriate ‘division of attention’ when completing flight log, etc., whilst manually controlling the aircraft. (E) Effective problem-solving and decision-making: Prioritise activities to allow maintenance of correct instrument scan.

BRUNEI DCA

Altimeter setting

Module 3: En-route IFR procedures	
Altimeter setting	
OBJECTIVE	Follow the altimeter-setting procedure, and cross-check and monitor en-route protected areas.
SKILL	(A) Correct use and interpretation of altimeter subscale setting. (B) Cross-check against a second altimeter.
KNOWLEDGE	(A) National procedures, if different, regarding altimeter settings for the airspace the aircraft is occupying. (B) Effects of extremely low temperatures on altimeter indications. (C) Limitations and errors in altimeters due to construction or systems installed in the aircraft, etc.
ATTITUDE	(A) Situation awareness: (1) Understand the airspace structure and make appropriate altimeter settings; (2) Be aware of minimum safe altitude, sector safe altitude, etc. (B) Effective workload management: As applicable to the specific situation. (C) Effective communication: Use appropriate RTF procedures to update pressure settings. (D) Leadership and teamwork: As applicable to the specific situation. (E) Effective problem-solving and decision-making: Where necessary, identify and make appropriate decisions when confronted with system failures.

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Timing and revision of estimated time of arrival (ETA) (en-route hold, if required)

Module 3: En-route IFR procedures	
Timing and revision of estimated time of arrival (ETA) (en-route hold, if required)	
OBJECTIVE	Understand the flight plan, and that the clearance is to be completed correctly.
SKILL	(A) Use appropriate and up-to-date aeronautical charts. (B) Extract and record pertinent information from NOTAMs, the aerodrome or facility directory, and other flight publications. (C) Plot a course for the intended route of flight. (D) Select the most favourable altitudes. (E) Compute headings, flight time, and fuel requirements.
KNOWLEDGE	(A) Weather reports and forecasts. (B) Pilot and radar reports. (C) Winds and temperatures aloft. (D) ATC procedures related to timing, e.g. update of ETA if changed by ± 3 minutes, clearance limit, etc
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Identify airspace, obstructions, and terrain features. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Demonstrate correct communication with ATC (where applicable). (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Select the appropriate navigation systems or facilities and communication frequencies. (E) Effective problem-solving and decision-making: Deal with unexpected navigation errors or systems malfunctions.

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Monitoring of flight progress, flight log, fuel usage and management, systems management

Module 3: En-route IFR procedures	
Monitoring of flight progress, flight log, fuel usage and management, systems management	
OBJECTIVE	(A) Maintain a flight log by recording sufficient information. (B) Monitor the engine and aircraft systems throughout the flight. (C) Monitor fuel consumption versus fuel available and fuel required throughout the flight.
SKILL	(A) Follow the flight plan route in accordance with ATC. (B) Navigate by means of an appropriate navigation system for the cleared route. (C) Use the correct altimetry procedures. (D) Verify the aircraft's position in relation to the flight-planned route. (E) Correctly assess track error and make suitable adjustments to heading. (F) Correct and record the differences between pre-flight fuel, ground speed, and heading and time calculations and those determined en-route. (G) Complete all appropriate checklists. (H) Manage the flight in accordance with minimum altitude.
KNOWLEDGE	(A) Part-SERA requirements and national rules regarding use of aerodromes procedures. (B) Policy concerning IFR flights (e.g. national procedures in the AIP). (C) Services expected in different classes of airspace. (D) Danger restricted, and prohibited areas. (E) Minimum altitude and protected areas.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Identify airspace and minimum altitudes. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Demonstrate correct communication (where applicable). (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Select appropriate navigation systems or facilities and communication frequencies. (E) Effective problem-solving and decision-making: Deal with unexpected navigation errors or systems malfunctions.

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Ice protection procedures, simulated if necessary

Module 3: En-route IFR procedures	
Ice protection procedures, simulated if necessary	
OBJECTIVE	(A) Monitoring of outside air temperature (OAT), icing risk and ice accretion rate (on FSTD if necessary); correct use of anti-icing and de-icing procedures. (B) Manage flight in icing conditions.
SKILL	(A) Assessment of ice accretion on aircraft. (B) Appropriate selection of anti-icing or de-icing systems. (C) Adapt the aircraft speed to stay within the flight manual limitations, if any. (D) Adapt the performance within the icing conditions. (E) Decision-making to avoid icing conditions.
KNOWLEDGE	(A) Weather reports and forecasts. (B) ATC, pilot and radar reports. (C) Surface analysis charts. (D) Ground radar summary charts. (E) Significant weather prognostics. (F) Forecast upper wind and temperature for aviation (WINTEM). (G) Freezing level. (H) SIGMETs. (I) ATIS and VOLMET reports. (J) Aircraft anti-icing and de-icing system limitations. (K) Significant weather chart (TEMSI).
ATTITUDE	(A) Situation awareness: (1) Understand the environmental conditions which can lead to the formation of ice on the aircraft; (2) Assess when ice accretion is outside the capability of the aircraft systems. (B) Effective communication: (1) Liaise with ATC to avoid known icing conditions; (2) Request change of route or level to avoid icing conditions. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Select appropriate navigation systems or facilities and communication frequencies. (E) Effective problem-solving and decision-making: (1) Deal with unexpected encounters with icing conditions or systems malfunctions; (2) Seek reroute or change of level in a timely manner.

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ATC liaison — compliance, RTF procedures

Module 3: En-route IFR procedures	
ATC liaison — compliance, RTF procedures	
OBJECTIVE	ATC liaison using the correct RTF procedures and phraseology, and compliance with ATC procedures and clearances.
SKILL	(A) Follow the flight-planned route or any other ATC route requirements within the specified operating limits. (B) Identify and use navigation systems correctly. (C) Monitor whether ATC clearance is in accordance with a safe flight. (D) Use the correct RTF procedures and phraseology
KNOWLEDGE	ICAO (language proficiency level 4, as a minimum) and national RTF procedures.
ATTITUDE	(A) Situation awareness: (1) Establish communication with ATC on the correct frequencies and at the appropriate times; (2) Identify airspace, and understand ATC clearances. (B) Effective communication: (1) Read back correctly, in a timely manner, the ATC clearance in the sequence received; (2) Demonstrate correct communication with ATC (where applicable). (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Select the appropriate navigation systems or facilities and communication frequencies. (E) Effective problem-solving and decision-making: Deal with unexpected navigation errors or systems malfunctions.

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(4) Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only)

Simulated engine failure after take-off or during go-around

Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only) (must be performed by sole reference to instruments) (Multi-engine aeroplanes only)	
Simulated engine failure after take-off or during go-around (at a safe altitude unless conducted in an adapted FSTD)	
OBJECTIVE	(A) Maintain the flight path after take-off or during go-around with one engine inoperative. (B) Comply with ATC instructions..
SKILL	(A) Maintain control following engine failure with sole reference to instruments. (B) Prepare a strategy in case of engine failure or go-around. (C) Calculate one-engine-inoperative performance. (D) Adapt minima on take-off or in approach in accordance with the performance. (E) Carry out the recommended emergency procedures.
KNOWLEDGE	(A) Operating manual: (1) all systems; (2) limitations; (3) abnormal procedures; (4) Part-NCO; (5) performance; (6) CS-23. (B) Operator policy dedicated to failure during take-off: in particular, operator engine-out path during take-off.
ATTITUDE	(A) Situation awareness: (1) Recognise engine failure, and confirm correct engine; (2) Performance limitations; (3) Strategy threats. (B) Effective communication: Communicate appropriately with ATC. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: (1) Apply appropriate abnormal or emergency procedures, time permitting, to resolve reason for engine failure; (2) Management of flight path close to the ground. (E) Effective problem-solving and decision-making: Identify critical situation and make timely decision on suitable actions to carry out a safe asymmetric flight path..

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Approach, go-around and procedural missed approach with one engine inoperative

Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only) (must be performed by sole reference to instruments) (Multi-engine aeroplanes only)	
Approach, go-around and procedural missed approach with one engine inoperative	
OBJECTIVE	(A) Manage IFR approach path during engine failure. (B) Maintain a stable approach in the correct configuration. (C) Make a clear decision to land or go around no later than the appropriate committal height or minima. (D) Complete asymmetric approach and go-around into visual circuit, circling approach or further instrument approach, maintaining control and correct speeds. (E) Initiate go-around action in case of destabilised approach. (F) Complete procedures and checks.
SKILL	(A) Apply the appropriate power setting for the flight condition and establish a pitch attitude necessary to achieve the desired performance. (B) Retract the wing flaps or drag devices and landing gear, if appropriate, in the correct sequence. (C) Accomplish the appropriate procedures or checklist items in a timely manner in accordance with the flight manual.
KNOWLEDGE	(A) Flight manual: (1) all systems; (2) limitations; (3) abnormal procedures; (4) patterns; (5) Part-NCO; (6) performance; (7) CS-23. (B) Operator policy dedicated to approach stabilisation criteria.
ATTITUDE	(A) Situation awareness: Recognise whether the approach profile is stabilised. (B) Effective communication: Communicate appropriately with ATC. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Apply appropriate abnormal procedures for asymmetric approach and go-around. (E) Effective problem-solving and decision-making: (1) Identify whether a critical situation is occurring due to inappropriate approach profile; (2) Make a timely decision to execute a go-around.

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Approach and landing with one engine inoperative

Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only) (must be performed by sole reference to instruments) (Multi-engine aeroplanes only)	
Approach and landing with one engine inoperative	
OBJECTIVE	(A) Establish the approach and landing configuration appropriate for the selected runway and prevailing meteorological conditions, and adjust the engine controls as required. (B) Complete the applicable pre-landing checklist. (C) Maintain a stabilised approach at the desired airspeed. (D) Maintain the operating engine(s) within acceptable operating limits. (E) Accomplish a smooth, positively controlled transition from instrument reference to visual reference. (F) Join smoothly, if necessary, the visual approach flight path. (G) Complete the applicable post-landing briefing or checklist items in a timely manner, after clearing the runway, and as recommended by the manufacturer.
SKILL	(A) Consider the actual weather and wind conditions, landing surface and obstructions. (B) Maintain a stable approach in the correct configuration. (C) Plan and follow suitable approach pattern and orientation with the landing runway. (D) Establish the correct approach configuration, adjusting speed and rate of descent to maintain a stabilised approach path. (E) Make a clear decision to land or go around no later than the appropriate committal height or minima. (F) Select and achieve the appropriate touchdown area at the required speed.
KNOWLEDGE	(A) Flight manual: (1) all systems; (2) limitations; (3) abnormal procedures; (4) patterns; (5) Part-NCO; (6) performance; (7) CS-23. (B) Understand the factors affecting asymmetric committal height/altitude (ACH/A).
ATTITUDE	(A) Situation awareness: Recognise whether the approach profile is stabilised, leading to a safe asymmetric landing. (B) Effective communication: Liaise with ATC. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Apply appropriate abnormal procedures for asymmetric approach and landing. (E) Effective problem-solving and decision-making: Make appropriate decision at asymmetric committal height (ACH) to commit to final flap selection and landing.

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ATC liaison — compliance, RTF procedures

Module 4: Optional flight with one engine inoperative (multi-engine aeroplanes only) (must be performed by sole reference to instruments) (Multi-engine aeroplanes only)	
ATC liaison — compliance, RTF procedures	
OBJECTIVE	(A) Inform ATC of abnormal flight condition and any assistance required. (B) Comply with ATC procedures and instructions.
SKILL	(A) Use standard RTF phraseology as far as possible and plain language as required when declaring an emergency. (B) Seek assistance as appropriate.
KNOWLEDGE	ICAO (language proficiency level 4 or higher) standard phraseology.
ATTITUDE	(A) Situation awareness: Communicate with ATC that an emergency has occurred. (B) Effective communication: Read back correctly, in a timely manner, the ATC clearance in the sequence received. (C) Leadership and teamwork: Demonstrate correct coordination with ATC (where applicable). (D) Effective workload management: Copy correctly, in a timely manner, the ATC clearance as issued. (E) Effective problem-solving and decision-making: Interpret correctly the ATC clearance received and ensure that it is compliant with aircraft in an asymmetric configuration.

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Subpart J - Instructors

GM1 FCL.900 Instructor certificates

General

(a) Nine instructor categories are recognised:

(1) FI certificate: aeroplane (FI(A)), helicopter (FI(H)),

(2) TRI certificate: aeroplane (TRI(A)), helicopter (TRI(H));

(3) CRI certificate: aeroplane (CRI(A));

(4) IRI certificate: aeroplane (IRI(A)) and helicopter (IRI(H));

(5) SFI certificate: aeroplane (SFI(A)) and helicopter (SFI(H));

(6) MCCI certificate: aeroplanes (MCCI(A)) and helicopters (MCCI(H));

(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 Brunei DCA 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 the , the Brunei DCA 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.

GM1 FCL.900(c); FCL.1000(c) Instruction or examination outside the territory of the Member States

Instruction or examination outside the territory of the Member States is possible within the scope of:

(a) ATOs that have their principal place of business outside the territory of the Member States; or

(b) ATOs that have their principal place of business in a Member State and one or more additional training sites outside the territory of the Member States.

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GM1 FCL.900(c)(1) Instructor certificates

Instruction outside the territory of the member states

The competent authority may issue an unrestricted flight instructor (FI) certificate (FI(A) for aeroplanes or FI(H) for helicopters) to an applicant that has at least 100 hours of experience in flight instruction and 25 hours in solo-flight supervision.

AMC1 FCL.915(e) General prerequisites and requirements for instructors

Additional requirements for instructing in a training course in accordance with FCL.745.A – general

(a) The objective of the course required by point FCL.915(e)(1) is to train instructors to deliver training on the advanced UPRT course according to point FCL.745.A using the train-to- proficiency concept.

(b) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching upset recovery techniques and strategies, whilst exploring the associated physiological and psychological aspects.

(c) Within 6 months preceding the start of the course, the instructor should have completed a pre- course assessment with an instructor holding the privilege in accordance with FCL.915(e)(1) to assess their ability to undertake the course.

(d) The training course should comprise:

(1) theoretical knowledge instruction on the theoretical knowledge elements presented in the advanced UPRT course and the additional elements required for an instructor to deliver effective training;

(2) flight instruction on the exercises used in the advanced UPRT course; and

(3) flight instruction on recovery from upsets that could result from students mis-handling the aircraft during the advanced UPRT course including spin recovery.

(e) The content of the theoretical knowledge and flight instruction should be tailored to the competence of the applicant as demonstrated during both pre-course and continuous assessment.

(f) Successful completion of the course requires that the instructor:

(1) demonstrates the resilience to be able to recover from any feasible upset in the aircraft to be used for training;

(2) demonstrates the ability to provide instruction to achieve the objectives of the advanced UPRT course to a wide range of trainees; and

(3) manages the physiological and psychological well-being of students during training.

(g) The instructor should be issued with a certificate following successful completion of the course.

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AMC2 FCL.915(e) General prerequisites and requirements for instructors

Additional requirements for instructing in a training course in accordance with FCL.745.A – syllabus

The following tables contain theoretical knowledge (Table 1) and practical training exercises (Table 2) that should be taught in the context of the advanced UPRT course as per point FCL.745.A.

TABLE 1: THEORETICAL KNOWLEDGE	
1.	Completion of a flight risk assessment
2.	Resilience-building strategies, managing startle and surprise
3.	The limitations and type-specific characteristics of the aeroplane used for training
4.	The importance of adhering to the scenarios that have been validated by the training programme developer
5.	Instructor techniques to induce and manage startle and surprise
6.	Upset recognition and recovery strategies
7.	Disorientation
8.	Distraction
9.	Immediate recognition of student pilot errors
10.	Intervention strategies
11.	Delivery of the theoretical knowledge instruction of the advanced UPRT course

TABLE 2: PRACTICAL TRAINING EXERCISES	
SECTION 1 — PRE-FLIGHT PREPARATION	
1.1	Correct completion of a flight risk assessment (such as weather, terrain, traffic density, student's experience level and capabilities)
1.2	Safety briefing
SECTION 2 — FLIGHT	
2.1	Selection of suitable airspace for the conduct of recovery exercises
2.2	Accurate execution of all of the manoeuvres required for the advanced UPRT course
2.3	Recovery from upsets that could result from the student or instructor mishandling the aeroplane including: – timely and appropriate intervention; – accelerated stall; – secondary stall; – incipient spin; – fully developed spin; and – Spiral dive.
2.4	Delivery of all of the training exercises in the advanced UPRT course
2.5	Anticipating and immediately recognising incorrect student inputs which might exceed aeroplane limitations and acting swiftly and appropriately to maintain the necessary margins of safety
2.6	Exercises to surprise the student
2.7	Adapt the training programme to take account of the physiological and psychological state of the student
2.8	Ensure the safety of the operation during training by maintaining awareness of the operating environment
2.9	Assess the competence of the student
SECTION 3 — POST-FLIGHT	
3.1	Provide effective instructor feedback to the student and plan subsequent training details
3.2	Avoid negative transfer of training

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GM1 FCL.915(e) General prerequisites and requirements for instructors

Training on spin avoidance and spin recovery

(a) While the purpose of advanced UPRT course is to expose students to psychological and physiological effects, students' responses and actions on controls may take any conceivable variations, including some which can initiate spin entry or, most importantly, can highly aggravate the upset or loss-of-control they are supposed to recover from.

(b) The advanced UPRT course in accordance with point FCL.745.A is not aerobatic training and only requires training for the incipient spin as well as uncoordinated side slipped stalls which are prone to initiating spins. Full spin training or the development of spin recovery proficiency is reserved for the training course in accordance with point FCL.915(e).

(c) Even though most flights will go exactly as planned without an unanticipated departure from controlled flight, the instructor is responsible for the safety of flight despite anomalies or unexpected student inputs.

(d) Even in a case where an aeroplane is not certified for intentional flat or aggravated or inverted spins, it does not mean that mishandled student recovery avoids placing the aeroplane in such a situation. Some student inputs will take the aeroplane uncontrolled far beyond the normal scope of the aerobatic rating as defined in point FCL.800. Those situations might also have the potential to draw the aeroplane outside its certified flight envelope (e.g. overloads, snap-roll departures above limit speed, spin or inverted spin when not certified for, flat spins, etc.). Most importantly, those resulting situations could startle the instructor.

(e) For the reasons specified in point (d), instructors should:

(1) be trained to the extent of proficiency on the specific type of aircraft they use to deliver the course;

(2) have academic understanding of the factors assisting or deterring spin recoveries (upright and inverted spins), altitude requirements for safe recovery margins, and other operational considerations;

(3) demonstrate that they have the ability to early recognise abnormal situations, timely take action, and safely recover from all the conditions that they may encounter in the delivery of training; and

(4) demonstrate their ability to recover from all spin types, not only from spins entered intentionally, but from spins of unannounced direction of autorotation, and from all potential spin variations, including:

(i) normal (non-aggravated) spins;

(ii) flat spins;

(iii) accelerated spins; and

(iv) transition spins (incorrect recovery resulting in reversal of rotation).

(f) In the context of points (d) and (e), it is recommended that candidates either hold an aerobatic rating for aeroplanes or have equivalent experience.

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AMC1 FCL.915(e)(2) General prerequisites and requirements for instructors

CONTENT OF THE REFRESHER TRAINING FOR UPRT INSTRUCTIONAL PRIVILEGES

(a) The objective of the refresher training is for the instructor to maintain or to re-obtain, as applicable, the level of competence required for instructing on a training course as per point FCL.745.A.

(b) The content of the refresher training should:

(1) consist of elements from the initial UPRT instructor training course as per point FCL.915(e)(1)(ii); and

(2) be determined by the ATO on a case-by-case basis, considering the needs of the individual instructor and taking into account the following factors:

(i) the experience of the instructor;

(ii) the amount of time elapsed since the instructor provided instruction on a training course as per point FCL.745.A for the last time; and

(iii) the performance of the instructor during a simulated UPRT training session comprising exercises from the advanced UPRT course as per point FCL.745.A. During this simulated training session, another instructor qualified in accordance with point FCL.915(e) should play the role of the student on the advanced UPRT course.

(c) Taking into account the factors listed in (b)(2) above, the ATO may also count the simulated training session as per point (b)(2)(iii) as refresher training without the need for further refresher training sessions, provided that the instructor demonstrates that he or she already possesses the required level of competence.

(d) The completion of the refresher training should be entered in the logbook of the instructor and should be signed by the head of training of the ATO.

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:

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Competence	Performance	Knowledge
Prepare resources	(a) ensures adequate facilities; (b) prepares briefing material; (c) manages available tools; (d) plans training within the training envelope of the training platform, as determined by the ATO (Note: See GM1 ORA.ATO.125 point (f)).	(a) understand objectives; (b) available tools; (c) competency-based training methods. (d) understands the training envelope of the training platform, as determined by the ATO (Note: See GM1 ORA.ATO.125 point (f)) and avoids training beyond the boundaries of this envelope.
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	(a) makes TEM or CRM links with technical training; (b) for aeroplanes: makes upset prevention 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.

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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.

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(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

(i) 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.

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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.

AMC1 FCL.935 Assessment of competence

General

(a) The format and application form for the assessment of competence are determined by the Brunei DCA.

(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 assessment of competence, 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 member 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.

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AMC2 FCL.935 Assessment of competence

MCCI, STI, FTI 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

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(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.		

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	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

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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 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 - RESERVED

(c) Report form for the FI for balloons: - RESERVED

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SECTION 2 – SPECIFIC REQUIREMENTS FOR THE FLIGHT INSTRUCTOR - FI

GM1 FCL.905.FI(h)(2) Privileges and conditions

FSTDs should not be used to pass an assessment of competence on the class or type of aircraft.

AMC1 FCL.930.FI Training course

FI(A) and FI(H) 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 assessment of competence 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.

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(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:

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(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';

(iii) situational awareness;

(iv) 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

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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.

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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;

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(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;

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(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;

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(2) relationship between power or air speed and rate of climb (power curves maximum rate of climb (vy));

(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 (vx).

(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;

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(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) vs1 & vso + 10 knots;

(ii) vs1 & vso + 5 knots.

(2) slow flight during instructor induced distractions; (3) effect of overshooting in configurations where application of engine power causes a strong ‘nose-up’ trim change.

(3) 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) vs1 + 10 knots and with flaps down;

(ii) vso + 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) vs1 + 5 knots and with flaps down;

(ii) vso + 5 knots;

(iii) straight and level flight;

(iv) level turns;

(v) climbing and descending;

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(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;

(vii) 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;

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(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;

(xi) 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;

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(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;

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(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;

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(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.

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(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;

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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;

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(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;

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(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:

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(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:

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(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.

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(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;

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(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;

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(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;

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(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:

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(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.).

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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;

(5) familiarisation with the helicopter controls;

(6) differences when occupying the instructor's seat;

(7) 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;

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(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 lookout).

EXERCISE 6: LEVEL FLIGHT, CLIMBING, DESCENDING AND TURNING

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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 lookout).

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;

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(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) 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 lookout).

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) 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;

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(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 lookout).

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;

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(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;

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(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;

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(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;

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(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.

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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 coordination;

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(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.

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(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;

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(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:

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(a) transponders;

(b) code selection;

(E) interrogation and reply.

(v) use of DME:

(A) station selection and identification;

(B) modes of operation: distance, groundspeed and time to run.

(vi) 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;

(6) technique for vertical take-off over obstacles;

(7) reconnaissance technique for landing site;

(8) power checks;

(9) technique for running landing;

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(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;

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(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).

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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 (RESERVED)

AMC2 FCL.930.FI FI Training course - RESERVED

FI(S) and FI(B) training course - RESERVED

Syllabus of flight instruction contents

A. Sailplanes - RESERVED

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B. Balloons - RESERVED

AMC1 FCL.940.FI; FCL.940.IRI Revalidation and renewal

(a) The instructor refresher training for the revalidation of the FI and IRI certificates should be provided as a seminar by either an ATO, DTO, or competent authority.

(1) FI or IRI refresher seminars made available in the should have due regard to geographical location, numbers attending, and periodicity.
(2) Such seminars should run for at least 2 days (1 day = 6 hours), 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.
(3) Appropriately 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.
(4) The attendance form will be completed and signed by the organiser of the seminar as approved by the Brunei DCA, following attendance and satisfactory participation by the FI or IRI.
(5) The content of the FI or IRI refresher seminar should be selected from the following:

(i) new or current rules or regulations, with emphasis on knowledge of Part - FCL and operational requirements;

(ii) teaching and learning;
(iii) instructional techniques;
(iv) the role of the instructor;
(v) national regulations (as applicable);
(vi) human factors;
(vii) flight safety, incident and accident preventions;
(viii) airmanship
(ix) legal aspects and enforcement procedures;
(x) navigational skills including new or current radio navigation aids;
(xi) teaching instrument flying;
(xii) weather-related topics including methods of distribution;
(xiii) any additional topic selected by the competent authority.

(6) Formal sessions should allow time for a presentations and related questions. The use of visual aids is recommended, with interactive videos and other teaching aids (where available) for breakout groups and workshops.

(b) If the instructor certificate lapsed, the ATO, DTO, or competent authority, whichever is appropriate to the category of aircraft, should consider all the above as well as the following, when assessing the refresher training programme:

(1) the ATO, DTO, or competent authority should determine on a case-by-case basics the amount of refresher training needed, following an assessment of the candidate taking into account the following factors:
(i) the experience of the applicant;
(ii) the amount of time elapsed since the expiry of the FI or IRI certificate; and
(iii) the technical elements of the FI or IRI training courses, as determined by the assessment of the candidate by the ATO, DTO, or competent authority; and
(2) the individual training programme should be based on the content of the FI or IRI training course and focus on the aspects where the applicant showed the greatest needs.

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(b) After successful completion of the seminar or refresher training, as applicable, the ATO, DTO, or competent authority should:

(1) in case of a seminar, in accordance with point (a), issue the applicant with a seminar completion certificate or another document specified by the competent authority, which describes the content of the seminar as in point (a), as well as a statement that the seminar was successfully completed; and

(2) in case of refresher training, in accordance with point (b), issue the applicant with a training completion certificate or another document specified by the competent authority, which describes the evaluation of the factors listed in point (b)(1) and the training received, as well as statement that the training was successfully completed; the training completion certificate should be presented to the examiner prior to the assessment of competence.

Upon successful completion of the refresher seminar or refresher training, as applicable, the ATO or DTO should submit the seminar or training completion certificate, or the other document specified by the competent authority, to the competent authority.

(c) taking into account the factors listed in point (b)(1), the ATO, DTO, or competent authority, as applicable, may also decide that it is sufficient for the candidate to complete a seminar in accordance with point (a). In such case, the completion certificate or the other document that is referred to in point (c) should contain a related statement with sufficient reasoning.

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FI – 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 a n 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:

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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:			

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C. Airships - RESERVED

D. Sailplanes instructional flying experience - RESERVED

E. Balloons - RESERVED

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SECTION 4 – SPECIFIC REQUIREMENTS FOR THE TYPE RATING INSTRUCTOR - TRI

GM1 FCL.905.TRI(b) Privileges and conditions

INSTRUCTORS INSTRUCTING FOR THE ISSUSE OF THE A TRI OR SFI CERTIFICATE

Training in an aeroplane is not a requirement for the issue of an SFI or a TRI certificate. In order to deliver effective UPRT, it is beneficial for the instructor to have first-hand experience of the critical psychological and physiological human factors, which might be present during recoveries from developed upsets. These human factors (effects of unusual acceleration, such as variations from normal 1G flight, the difficulty to perform counter-intuitive actions, and the management of the associated stress response) can only be experienced during training in an aeroplane because FFSs are not capable of reproducing sustained accelerations. Completion of the advanced UPRT course in accordance with FCL.745.A would provide such experience and is therefore useful for instructors providing instruction for the issue of a TRI or an SFI certificate.

GM1 FCL.910.TRI TRI Restricted privileges

(a) The restriction of the TRI privileges are annotated on the license under 'Remarks and Restrictions' against appropriate TRI certificate, along with the following endorsements:

(1) if the training is carried out in an FSTD: 'TRI/r' (r = restricted);

(2) if the TRI training, as specified in point FCL.910(a)(1), includes the LIFUS training: endorsement as per point (a) and 'LIFUS'; and

(3) if the landing training, as per specified in point FCL.910.TRI(a)(2), is included in the TRI training course: endorsement as per point (a) and 'LT' (LT = landing training).

(b) For example, a TRI restricted with LIFUS and landing training privileges will have on their license the following endorsement: 'TRI/r LIFUS LT'.

GM1 FCL.910.TRI(b)(2) TRI training for type extension

'Relevant parts of the technical training and the flight instruction parts of the applicable TRI training course' means that the training should be relevant to its purpose, taking into consideration the experience of the individual TRI on other aircraft types are similar to the one for which the extension of TRI privileges is applied for.

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AMC1 FCL.930.TRI - Training course

TRI TRAINING COURSE – AEROPLANES

(a) General

(1) The training course should develop safety awareness throughout by imparting knowledge, skills and attitudes relevant to the TRI task, and should be designed to adequately train the candidate instructor in theoretical-knowledge instruction, flight instruction, and FSTD instruction to enable the candidate instructor to instruct others on an aeroplane type rating for which the candidate instructor is qualified.

(2) The TRI (A) training course should place particular emphasis on the role of the individual, human factors in the man-machine environment, and CRM.

(3) Special attention should be given to the candidate instructor's maturity and judgement including their understanding of adults, behavioural attitudes, and variable levels of learning ability. During the training course, the candidate instructor should be made aware of their own attitude towards the importance of flight safety.

(4) For a TRI(A), the amount of time for flight training should vary depending on the complexity of the aeroplane type. A similar number of hours should be allotted to the instruction on, and practice of, both pre-flight and postflight briefing for each exercise.

(5) The flight instruction should ensure that the candidate instructor is able to teach the air exercise safely and efficiently and should be related to the type of aeroplane on which the candidate instructor wishes to instruct. The content of the training programme should cover training exercises applicable to the aeroplane type, which are set out in the applicable type rating training courses.

(6) Airmanship is a vital element of all flight operations. Therefore, in the following exercises, the relevant aspects of airmanship should be stressed at the appropriate times during each flight.

(7) The candidate instructor should learn how to identify the common errors and how to correct them properly, which should be emphasised at all times.

(b) Content

The training course consists of three parts:

- Part 1: teaching and learning instruction in accordance with AMC1 FCL.920;
- Part 2: technical theoretical-knowledge instruction (technical training); and
- Part 3: flight instruction.

(1) Part 1 – Teaching and learning

The content of the teaching and learning part FI training course as described in AMC1 FCL.930.FI should be used as guidance to develop the course syllabus.

(2) Part 2 – Technical theoretical-knowledge instruction syllabus

(i) If a TRI(A) certificate for MP aeroplanes is sought, particular attention should be given to MCC. Is a TRI(A) certificate for SP aeroplanes is sought, particular attention should be given to the duties in SP operations.

(ii) The technical theoretical-knowledge instruction should comprise at least 10 hours of training to refresh Part-1 theoretical topics, as necessary, and aircraft technical knowledge. It should include preparation of lesson plans and development of briefing-room instructional skills. A proportion of the allotted 10 hours could be integrated into the practical flight instruction lessons of Part 3, using expanded pre-flight and postflight briefing sessions. Consequently, for practical purposes, Part 2 and Part 3 could be considered complementary to each other.

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(iii) 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 syllabus and the candidate instructor should prepare and deliver lectures on topics that are selected by the course instructor from the type rating course.

(3) Part 3 – Flight instructions

(i) General

(A) The course should be related to type of aeroplane on which the applicant wishes to instruct. It should consist of at least 5 hours of flight instruction for SP aeroplanes that are operated in SP operations, and at least 10 hours for MP aeroplanes or SP-certified aeroplanes that are operated in MP operations, per candidate instructor.

(B) TEM, CRM and the appropriate use of behavioural makers should be integrated throughout.

(C) Training courses should be developed to help the candidate instructor gain experience in the training of a variety of exercises, covering both normal and abnormal operations.

(D) The syllabus should be tailored and appropriate to the aeroplane type and the exercises used should be more demanding for each individual student.

(E) The course should cover the whole range of instructor skills to enable the candidate instructor to plan sessions, brief, train and debrief using all relevant training techniques that are appropriate to pilot training.

(ii) Use of FSTDs

(A) The applicant for a TRI(A) certificates should be instructed in using the device and made familiar with its limitations, capabilities and safety features, including emergency evacuation.

(B) The applicant for TRI(A) certificate should be instructed in providing and evaluating training from the instructor station and from all pilot operating positions, including demonstration of handling exercises.

(C) The syllabus should include engine-out handling and engine-out operations in addition to representative exercises from the type rating course.

(D) Where no FSTD exists for the type of aeroplane for which the certificate is sought, or if the FSTD is not suitable to complete all the elements of the training programme for the TRI certificate, the entire course or a part of it should be conducted in the applicable aeroplane type, and the synthetic-device elements should be replaced with appropriate exercises in the aeroplane.

The assessment of competence should be performed:

- when no FSTD exists, in the aeroplane; and
- when not all elements of the training are completed in the FSTD, in both that aeroplane and the FSTD; this combined use of aeroplane and FSTD in the assessment of competence should reflect and be similar to the combined use of aeroplane and FSTD during the training course.

(F) In general, TRI training is designed to develop the competencies of a pilot to become an instructor. From this perspective, the training may be provided in several arrangements:

- the candidate instructor is seating in either pilot seat;
- the candidate instructor is seating at the IOS; or

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- the candidate instructor is observing (seating as an observer).

The combination of the above-mentioned training arrangements and the allocation of time to each one of them depends on an analysis of several elements, including but not limited to the following:

- one candidate is sitting at the controls (supported by a suitable pilot), while the second candidate is sitting at the IOS; this scenario may be used for demonstration of flight manoeuvres or engine out exercises; or
- both candidates receive instruction (general introduction and handling) at the IOS.

In this way, both candidates can independently develop specific competencies.

Additional TRI candidate instructors may be present as observers during such an instruction given in parallel, with no credit of hours for their TRI training.

For an initial TRI training course, such 'in parallel' instruction should be given only for reasonable part of the overall TRI training course duration. For a TRI type extension, the amount of hours required for such an instruction may be increased.

In any case, the way of instruction largely depends on the experience of the TRI trainer in the various training arrangements and on the general experience of the candidate instructor.

(iii) SP MET aeroplane training for asymmetric power flight

During this part of the training, particular emphasis should be placed on:

(A) the circumstances under which the actual feathering and unfeathering is practised, e.g. safe altitude, compliance with regulations regarding minimum altitude or height for feathering, weather conditions, distance from the nearest available aerodrome;

(B) the procedure that should be used for cooperation between instructor and student, e.g. the correct use of touch drills and the prevention of misunderstandings, especially during feathering and unfeathering and when zero thrust is used for asymmetric circuits; this procedure should include a positive agreement on which engine should be shut down or restarted or set at zero thrust, as well as on identifying each control and the engine it will affect;

(C) avoiding overworking the operating engine and preventing degraded performance when operating the aeroplane in asymmetric flight; and

(D) the need to use the specific checklist for the given aeroplane type.

(iv) Long briefings on SP MET aeroplanes

Long briefings provide an essential link between academic principles and air exercises. They introduce aeronautical theory and the practical application of aeronautical principles to the student.

The instructor should ensure that the candidate instructor is able to teach all the following subjects:

(A) Asymmetric power flight:

(a) introduction to asymmetric flight;

(b) feathering the propeller: method of operation;

(c) effects on aeroplane handling at cruising speed;

(d) introduction to the effects upon aeroplane performance;

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(e) identification of the foot load to maintain a constant heading (no rudder trim);

(f) feathering the propeller: regaining normal flight;

(g) finding the zero-thrust setting; comparison of foot load when the propeller is feathered and thrust is set to zero;

(h) effects and recognition of engine failure in level flight;

(i) forces and effects of yaw;

(j) type of failure:

(1) sudden or gradual, and

(2) complete or partial;

(k) yaw direction and further effects of yaw;

(l) flight instrument indications;

(m) identification of failed engine;

(n) couples and residual out-of-balance force: resultant flight attitudes;

(o) use of rudder to counteract yaw;

(p) use of aileron: dangers of misuse;

(q) use of elevator to maintain level flight;

(r) use power to maintain safe airspeed and altitude;

(s) supplementary recovery to straight and level flight: simultaneous increase in speed and reduction in power;

(t) identification of failed engine: idle engine;

(u) use of engine instruments for identification:

(1) fuel pressure or flow;

(2) RPM gauge response effect of constant speed unit (CSU) action at lower and higher airspeed; and

(3) engine temperature gauges;

(v) confirmation of identification: closing the throttle of the identified failed engine;

(w) effects and recognition of engine failure in turns;

(x) identification and control; and

(y) side forces and effects of yaw.

(B) Turning flight:

(a) effect of ‘inside’ engine failure: sudden and pronounced effect;

(b) effect of ‘outside’ engine failure: less sudden and pronounced effect;

(c) possible confusion in identification (particularly at low power):

(1) correct use of rudder; and

(2) possible need to return to lateral level flight to confirm correct identification;

(d) visual and flight instrument indications;

(e) effect of varying speed and power;

(f) speed and thrust relationship;

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(g) at normal cruising speed and cruising power: engine failure clearly recognised;

(h) at low safe speed and climb power: engine most likely recognised; and

(i) at high-speed decent and low power: asymmetry (engine failure) possibly not recognised.

(C) Minimum control speeds:

(a) Air speed indicator (ASI) colour coding: red radical line. Note: this exercise is intended to explore the ultimate boundaries of controllability of the aeroplane aircraft in a asymmetric state in various conditions with a steady power setting. A steady power setting is achieved by using a fixed power setting and adjusting the aircraft attitudes to obtain a gradual speed reduction. The failure exercise should not be performed as a sudden and complete failure at the V_{MCA} given in the AFM. The purpose of the exercise is to continue the gradual introduction of a student to the control of an aeroplane in asymmetric power flight in extreme or critical situations, and not to demonstrate V_{MCA}.

(b) Techniques for assessing critical speeds at wings level, and recovery from those speeds; dangers involved when minimum control speed and stalling speed are very close: use of safe single-engine speed (V_{sse}).

(c) Establishing a minimum control speed for each asymmetrically disposed engine: establishing the critical engine (if applicable).

(d) Effects on minimum control speeds of:

(i) bank;

(ii) zero-thrust setting; and

(iii) take-off configuration:

(A) landing gear down and take-off flap set; and

(B) landing gear up and take-off flap set.

Note: the use of 5° of bank towards the operating engine results in a better climb performance than that obtained with wings level held. Manufactures may use these conditions when determining the asymmetric climb performance of the aircraft. Thus, the V_{MCA} quoted in the AFM may be different from the speeds that are determined during this exercise.

(D) Feathering and unfeathering:

(a) minimum heights for practising feathering and unfeathering drills; and

(b) engine-handling precautions (overheating, icing conditions, priming, warm-up, method of simulating an engine failure: refer to the aircraft engine manual, service instructions, and bulletins.)

(E) Engine failure procedure:

(a) once control is maintained, the phase of operation and the operation and the aircraft type determine in which order procedures should be followed; and

(b) the flight phase should be:

(1) in cruising flight; or

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(2) a critical phase, e.g. immediately after take-off or during approach to landing or during a go-around.

(F) Aircraft type:

Variations in the order of certain drills and checks inevitably occur due to differences between aeroplane types and perhaps between models of the same aeroplane type. The AFM should be consulted to establish the exact order of the related procedures.

For example, one AFM may call for the raising of the landing gear doors, and as a result, retraction should be avoided until feathering is completed and propeller drag reduced.

However, 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, retraction should be avoided until feathering is completed and propeller drag reduced.

Therefore, the order in which the drills and checks are presented under immediate and subsequent actions in this syllabus should be considered as general guidance only; the exact order of precedence is determined by reference to the AFM for the specific aeroplane type used in the course.

(G) In-flight engine failure during cruising or other flight phase not including take-off or landing:

(a) immediate actions:

(1) control of the aircraft;

(2) recognition of asymmetric condition;

(3) identification and confirmation of failed engine:

(i) Idle leg = idle engine; and

(ii) closing of throttle or pulling back of power lever, as appropriate, for confirmation;

(4) identification of failure cause and fire check:

(i) typical reasons for failure; and

(ii) methods of rectification; and

(5) feathering decision and procedure:

(i) reduction of other drag;

(ii) need for speed but not haste; and

(iii) use of rudder trim;

(b) subsequent actions:

(1) operating engine:

(i) temperature, pressure, and power;

(ii) remaining services;

(iii) electrical load: assess and reduce, as necessary;

(iv) effect on power source for air-driven instruments;

(v) landing gear; and

(vi) flaps and other services;

(2) replanning of the flight:

(i) ATC and weather;

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(ii) terrain clearance, SE cruising speed; and

(iii) decision to divert or continue;

(3) fuel management: best use of remaining fuel;

(4) dangers of restarting damaged engine;

(5) action if unable to maintain altitude: effect of altitude on available power;

(6) effects on performance;

(7) effects on available power and required power;

(8) effects on various airframe configurations and propeller settings;

(9) use of AFM;

(i) cruising;

(ii) climbing: ASI colour coding (blue line);

(iii) descending; and

(iv) turning;

(10) limitations and handling of operating engine; and

(11) control and performance of take-off and approach.

(H) Significant factors:

(a) significance of take-of safety speed:

(1) effect on aeroplane performance of landing gear, flap, feathering, take-off, trim setting, and systems for operating landing gear and flaps; and

(2) effect on aeroplane performance of mass, altitude, and temperature;

(b) significance of best SE climb speed (V_{yse}):

(1) accelerating to V_{yse} and establishing a positive climb;

(2) relationship between V_{yse} and normal climb speed; and

(3) action, if unable to climb; and

(c) significance of asymmetric committal height and speed: action, if baulked below asymmetric committal height.

(I) Engine failure during take-off:

(a) below V_{MCA} or unstick speed:

(1) use AFM data, if available; and

(2) accelerate or stop distance considerations;

(b) above V_{MCA} or unstick speed and below safety speed;

(c) immediate relanding or use of remaining power for forced landing; and

(d) considerations:

(1) degree of engine failure;

(2) speed at the time;

(3) mass, altitude, temperature performance;

(4) configuration;

(5) length of remaining runway; and

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(6) position of any obstacles ahead.

(J) Engine failure after take-off:

(a) simulated at a safe height and at or above take-off safety speed;

(b) considerations:

(1) need to maintain control;

(2) use of bank technique towards operating engine;

(3) use of available power to reach V_{yse};

(4) mass, altitude, temperature performance; and

(5) effect of prevailing conditions and circumstances;

(c) immediate actions:

(1) maintaining control, including airspeed and use of power;

(2) recognition of asymmetric condition;

(3) identification and confirmation of failed engine;

(4) feathering and removal of drag (procedure for specific type); and

(5) reaching and maintaining V_{yse}; and

(d) subsequent actions, whilst carrying out an asymmetric power climb to the downwind position at V_{yse};

(1) identification of failure and fire check;

(2) handling considerations for operating engine;

(3) remaining services;

(4) liaison with ATC; and

(5) fuel management.

Note: these procedures are dependent upon the aeroplane type concerned and actual flight situation.

(K) Asymmetric committal height

(a) Asymmetric committal height is the minimum height needed to put the aircraft into a positive climb, whilst maintaining an adequate speed to control the aircraft and reduce drag during an approach to landing.

(b) Due to the significantly reduced performance of many CS-23 aeroplanes when operating with one engine, a minimum height should be considered from which it would be safe to attempt a go-around procedure during an approach when the aeroplane must change from descent to climb in a high-drag configuration.

(c) Due to the height loss that occurs when the operating engine is turned to full power, with landing gear and flap retracted, and the aeroplane is put into a climb at V_{yse}, a minimum height (often referred to as 'asymmetric committal height') should be selected below which the pilot should not attempt to fly another circuit. This height should be compatible with the aeroplane type, all-up weight, altitude of the aerodrome used, air temperature, wind, height of obstructions along the climb-out path, and the pilot's competence.

(d) Circuit approach and landing with asymmetric power:

(1) definition and use of asymmetric committal height;

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(2) use of standard pattern and normal procedures;

(3) action, if unable to maintain circuit height;

(4) speed and power settings required; and

(5) decision to land or execute a go-around at asymmetric committal height: factors to be considered.

(e) Undershooting: importance of maintaining an appropriate airspeed.

(L) Speed and heading control:

(a) relationship between height, speed, and power: need for minimum possible drag; and

(b) reaching a positive climb at V_{yse} :

(1) effect of availability of systems, and power for the flap and landing gear; and

(2) operation and rapid clean-up.

Note 1: the airspeed at which the decision is made to make a landing or execute a go-around should normally be V_{yse} and not lower than the safety speed.

Note 2: instrument approach 'decision height' and its associated procedures should not be confused with the selection of minimum height for initiating a go-around in asymmetric power flight.

(M) Engine failure during an all-engine approach or missed:

(a) use of asymmetric committal height, and speed considerations; and

(b) speed and heading control: decision to attempt a landing, go-around or forced landing depending on circumstances.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(N) Instrument flying with asymmetric power:

(a) considerations relating to aircraft performance during:

(1) straight and level flight;

(2) climb and descent;

(3) standard rate turns; and

(4) level, climbing, and descending turns including turns to preselected headings;

(b) availability of vacuum-operated instruments; and

(c) electrical power source.

(v) Specific trainings: LIFUS training and landing training

The applicant for a TRI(A) certificate should receive instruction in an FSTD in accordance with FCL.930.TRI(a)(4).

(A) LIFUS training content

(a) Training in an FSTD:

(1) familiarisation as PF on both seats, as applicable, which should include at least the following:

(i) pre-flight preparation and use of checklists;

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(ii) taxing;

(iii) take-off;

(iv) rejected take-off;

(v) engine failure during take-off, after take-off decision speed (V_1);

(vi) one-engine-inoperative approach and go-around;

(vii) one-engine-inoperative (critical, simulated) landing;

(viii) other emergency and abnormal operating procedures (as necessary);

(ix) emergency evacuations; and

(x) task sharing and decision-making; and

(2) aeroplane training techniques:

(i) methods of providing appropriate commentary; and

(ii) intervention strategies developed from situations that are role-played by TRI training course instructor, taken from but not limited to:

(A) take-off:

- tail strike awareness and avoidance,
- rejected take-off,
- actual engine failure,
- take-off configuration warning, and
- overcontrolling;

(B) approach and landing:

- normal approach,
- high flare, long float, no flare,
- immediate go-around after touchdown,
- baulked landing,
- rejected landing,
- crosswind, and
- overcontrolling; and

(C) flight management:

- task sharing and handover of controls,
- effect of ATC-delaying actions on endurance,
- alternate management and diversion, and
- traffic awareness when flying in pattern.

(b) Training in aeroplane (in flight)

This training should consist of at least one route sector where the candidate instructor:

(1) either observes a TRI(A) who conducts line flying under supervision, or

(2) conducts role play line flying under supervision for a TRI(A) who is qualified for line flying under supervision.

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Upon completion of the above-mentioned training, the candidate instructor should complete a route sector under the supervision and to the satisfaction of a TRI(A) which is nominated for that purpose by the ATO.

(B) Landing training: content

(a) Training in an FSTD

The training in an FSTD should be tailored and appropriate to the aeroplane type, and the exercises should be more demanding for each candidate instructor. In addition to the LIFUS training items in the FSTD (listed under (a)(1) and (a)(2) above), the landing training should comprise a variety of exercises that cover both normal and abnormal operations including the following:

(1) consideration of threats during touch-and-go:

- operating at low attitude;
- General Aviation (GA) traffic;
- increased fuel consumption;
- bird strikes;
- decision to continue touch-and-go or make a full-stop landing; and
- aspects of performance and associated risks;

(2) incorrect rudder inputs;

(3) failure of a critical engine;

(4) approach and full-stop landing in simulated engine-out flight;

(5) go-around in simulated engine-out flight. The application needs to be additionally trained in other abnormal items during the training course, if required.

(b) Training in an aeroplane

(1) Upon completion of the FSTD training, the applicant should perform role-play flying for landing training under the supervision and to the satisfaction of a TRI(A) who is nominated for that purpose by the ATO.

The training should cover at least the following elements:

- take-off
- traffic pattern,
- touch-and-go,
- go-around, and
- full-stop landing with different flap settings.

(2) In exceptional circumstances, it may be necessary to perform simulated engine-out handling and engine-out operations in an aeroplane in addition to representative exercises from the type rating course.

(vi) UPRT

Instructors should have the specific competence to provide UPRT during the type rating training course, including the ability to demonstrate knowledge

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and understanding of the type-specific upset recovery procedures and of the recommendations that are developed by the original equipment manufactures (OEMs). Therefore, during the TRI training course, the student instructor should:

(A) be able to apply the correct upset recovery techniques for the specific aeroplane type;

(B) understand the importance of applying type-specific OEM procedures for recovery manoeuvres;

(C) be able to distinguish between the applicable SOPs and OEM recommendations (if available);

(D) understand the capabilities and limitations of the FSTDs that are used for UPRT;

(E) ensure that the training remains within the FSTD training envelope to avoid the risk of negative transfer of training;

(F) understand and be able to use the IOS of the FSTD in the context of providing effective UPRT;

(G) understand and be able to use the available FSTD instructor tools to provide accurate feedback on pilot performance;

(H) understand the importance of adhering to the FSTD UPRT scenarios that are validated by the training programme developer; and

(I) understand the missing critical human factor aspects due to the limitations of the FSTD, and convey this to the student pilot(s) receiving the training.

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.

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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) flight planning.

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(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;

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(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;

(J) abnormal and emergency procedures and appropriate methods and minimum altitudes for simulating failures in the helicopter;

(K) 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

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applicable type, subject to any restrictions placed on the conduct of critical exercises associated with helicopter flight manual limitations and safety considerations.

AMC1 FCL.940.TRI(a)(1)(ii), (a)(2)(ii), (b)(1)(ii); FCL.940.SFI(a)(2), (e)(1)

(a) The refresher training for revalidation of the TRI and SFI certificates should be provided as a seminar. The seminar should consist of 6 hours of learning and may be held in the form of either one or more of the following: e-learning, two-way online meetings, face-to-face seminars. The content of the refresher seminar for revalidation should be selected from the following items:
   (1) relevant changes to national or EU regulations;
   (2) the role of the instructor;
   (3) teaching and learning styles;
   (4) observational skills;
   (5) instructional techniques;
   (6) briefing and debriefing skills;
   (7) TEM;
   (8) human performance and limitations;
   (9) flight safety, prevention of incidents and accidents, including those specific to the ATO;
   (10) significant changes in the content of the relevant part of the aviation system;
   (11) legal aspects and enforcement procedures;
   (12) developments in competency-based instruction;
   (13) report writing; and
   (14) any additional topics proposed by the competent authority.

(b) For the refresher training for renewal of the TRI and SFI certificates:
   (1) the ATO should determine on a case-by-case basis the amount of refresher training needed, through an assessment of the candidate, taking into account the following factors:
      (i) the experience of the applicant;
      (ii) the amount of time elapsed since the expiry of the TRI or SFI certificate; and
      (iii) the technical elements of the TRI or SFI training course, as determined by the assessment of the candidate by the ATO;
   (2) the ATO should also consider the elements defined in point (a) above to above to determine the refresher training needed; and
   (3) once the ATO has determined the needs of the applicant, it should develop an individual training programme that should be based on the content of the TRI or SFI training course and focus on the aspects where the applicant has the greatest needs.

(c) After successful completion of the seminar or refresher training, as applicable, the ATO should:
   (1) in case of seminar, in accordance with point (a), issue the applicant with a seminar completion certificate or another document specified by the competent authority, which describes the content of the seminar as in point (a), as well as a statement that the seminar was successfully completed; and
   (2) in case of refresher training, in accordance with point (b), issue the applicant with a training completion certificate or another document specified by the competent authority, which describes the evaluation of the factors listed in point (b)(1) and the training received, as well as statement that the training

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was successfully completed; the training completion certificate should be presented to the examiner prior to the assessment of competence.

(d) Upon successful completion of the seminar or refresher training, as applicable, the ATO should submit the seminar or training completion certificate, or the other document specified by the competent authority, to the competent authority.

SECTION 5 – SPECIFIC REQUIREMENTS FOR THE CLASS RATING INSTRUCTOR - CRI

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, except for single-pilot high performance complex 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, except for single-pilot high-performance complex aeroplanes.

(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 be in accordance 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

(a) The technical theoretical-knowledge instruction should comprise at least 10 hours of training to include the revision of technical knowledge, preparation of lesson plans, and development of classroom instructional skills to enable the CRI to teach the technical theoretical-knowledge syllabus.

(b) The types or class rating theoretical syllabus should be used to develop the CRI teaching skills in relation to the type or class technical course syllabus. The course instructor should deliver example lectures from the applicable type or class technical syllabus. The candidate instructor should prepare and deliver lectures on topics that are selected by the course instructor from the type/class rating course and the generic topics listed further below.

(c) The 10 hours of technical theoretical-knowledge instruction should develop the applicant's ability to teach a student the student the knowledge and understanding that are required for the relevant air exercises for either SE or ME aeroplanes, depending on the privileges sought by the candidate.

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(d) If CRI privileges for both SE and ME aeroplanes are sought, the applicant should complete 10 hours of technical theoretical-knowledge instruction related to SE and ME aeroplanes each.

(e) This following syllabus of general subject concerns training only on ME aeroplanes.

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}):

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(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.

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(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;

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(12) stalling and recoveries;

(13) instrument flight: basic;

(14) emergency drills (not including engine failure);

(15) circuit, approach and landing:

(i) into wind;

(ii) crosswind;

(iii) short field;

(16) mislanding and going around again;

(17) actions after flight.

Air exercises

(a) The syllabus for CRI SE and Me training course should comprise air exercise 1 to 4 and should not last less than 3 hours. In addition, the syllabus for a CRI ME training course should also include air exercise 5 to address asymmetric power flight and should not last seen than 2 hours.

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;

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(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;

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(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.

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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 Vf_e;

(ii) effect on pitch attitude;

(iii) effect on air speed.

(4) operation of landing gear:

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(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 bank;

(iv) instrument appreciation.

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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;

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(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;

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(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.

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(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}.

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(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

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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;

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(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:

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(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;

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(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;

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(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 Vsse): 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

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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);

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(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;

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(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.

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EXERCISE 5: UPRT

Instructors should have the specific competence to provide UPRT during the type rating course, including the ability to demonstrate knowledge and understanding of the type-specific upset recovery procedures and of the recommendations that are developed by the OEMs. Therefore, during the CRI training course, the student instructor should:

(a) be able to apply the correct upset recovery techniques for the specific aeroplane type;

(b) understand the importance of applying type-specific OEM procedures for recovery manoeuvres;

(c) be able to distinguish between the applicable SOPs and OEM recommendations (is available);

(d) understand the capabilities and limitations of the FSTDs that are used for UPRT;

(e) ensure that the training remains within the FSTD training envelope to avoid the risk of negative transfer of training;

(f) understand and be able to use the IOS of the FSTD in the context of providing effective UPRT;

(g) understand and be able to use the available FSTD instructor tools to provide accurate feedback on pilot performance;

(h) understand the importance of adhering to the FSTD UPRT scenarios that are validated by the training programme developer; and

(i) understand the missing critical human factor aspects due to the limitations of the FSTD, and convey this to the student pilot(s) receiving the training.

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 or competent authority. 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 or competent authority for the revalidation of the certificate. The amount of refresher training needed should be determined on a case by case basis by the ATO or competent authority, 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 elapsed 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 elapsed.

(b) Once the ATO or competent authority 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.

(c) After successful completion of the refresher training, as applicable, the ATO or competent authority, should, in accordance with point (b), issue the applicant with a training completion certificate or another document specified by the competent authority, which describes the evaluation of the factors listed in point (a)(1) (the experience of the applicant) and the training received, as well as statement that the

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training was successfully completed. The training completion certificate should be presented to the examiner prior to the assessment of competence.

Upon successful completion of the refresher training, as applicable, the ATO should submit the training completion certificate, or the other document specified by the competent authority, to the competent authority.

SECTION 6 – SPECIFIC REQUIREMENTS FOR THE INSTRUMENT RATING INSTRUCTOR - IRI

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.

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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;

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(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;

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(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;

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(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: 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;

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(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:

(6) 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;

(7) 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.

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Exercise 2: Instrument 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).

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(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;

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(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;

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(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.

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(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: 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;

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(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;

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(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)

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(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;

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(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;

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(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;

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(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);

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(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.

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(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 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;

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(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.

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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;

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(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 (RESERVED)

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SECTION 8 – SPECIFIC REQUIREMENTS FOR THE MULTI-CREW COOPERATION INSTRUCTOR - MCCI

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.

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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 v1;

(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.

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Subpart K - Examiners

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 Brunei DCA 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 1 years established in the rule.

GM2 FCL.1000 Examiner certificates

When examiners conduct a skill test, proficiency check or assessment of competence, in addition to a licence for the relevant aircraft category, they are required to hold the rating or certificate equivalent to the one for which they conduct the skill test, proficiency check or assessment of competence.

For example, a candidate who holds a CPL(A) may make a class rating proficiency check on an SE piston aeroplane with an examiner who holds a PPL(A) with an SE piston class rating and related examiner privileges.

GM1 FCL.1005(b) Limitation of privileges in case of vested interests

Examples of a situation where the examiner should consider if ~~his/her~~ their objectivity is affected are when the applicant is a relative or a friend of the examiner, or when they are linked by economic interests or political affiliations, etc.

AMC1 FCL.1010 Prerequisites for examiners

When evaluating the applicant's background, Brunei DCA should evaluate the personality and character of the applicant, and his/her cooperation with Brunei DCA.

Brunei DCA 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.

AMC1 FCL.1015 Examiner standardisation

General

(a) Brunei DCA may provide the course itself or through an arrangement with an ATO or, in the case of examiners for sailplanes and balloons, with a DTO.

This arrangement should clearly state that the ATO or the DTO is acting under the management system of Brunei DCA.

(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 real or role-played proficiency checks, skill tests or assessments of competence (at least 2 days).

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(c) The Brunei DCA, the ATO or the DTO 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 and the organisational structure of DTOs;

(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 .

(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

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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 Brunei DCA 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

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(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. Aircraft that fall under points (a), (b), (c), or (d) of Annex I to the Basic Regulation can be used provided that they are subject to an authorisation as per point ORA.ATO.135 or point DTO.GEN.240.

(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 or the operator for which the applicant is flying, as applicable, or, if available, within the limitations placed by the DTO.

(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.

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(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) two tests or checks related to MPL or ATPL;

(3) two assessments of competence related to instructor certificates;

(4) 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 instructor certificates, 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 documentation.

(c) For the conduct of the test, check o assessment of competence, without additional activities specified in point (b), the following values may be used as guidance:

(1) 90 minutes for LAPL(A) or (H), PPL(A) or (H), and CPL(A) or (H), including the navigation section;

(2) 60 minutes for IR, EIR, instrument certificates, and SP type or class ratings; and

(3) 120 minutes for MPL, ATPL, and MP type ratings.

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GM1 FCL.1015(a); FCL.1025(b)(2)

EXAMINER STANDARDISATION COURSES AT AN ATO OR A DTO

In point FCL.1015(a) (second sentence) and in point FCL.1025(b)(2) (second sentence), the word 'may' is used to indicate that completing an examiner standardisation course or an examiner refresher course at a DTO is an option which can be used by examiners for sailplanes and balloons as an alternative to completing such courses provided by the competent authority or an ATO (first sentence in both point FCL.1015(a) and point FCL.1025(b)(2)).

AMC1 FCL.1020 Examiners assessment of competence

General

(a) The Brunei DCA 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 Brunei DCA 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 Brunei DCA who is conducting the examiner certification acceptance test.

Conduct of the assessment

(c) An inspector of the Brunei DCA 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);

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(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.

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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 Brunei DCA 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 Brunei DCA;

(3) have conducted a number of skill tests or proficiency checks as a Part-FCL examiner.

(a) The Brunei DCA 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 Brunei DCA.

(b) Applicants should be required to attend a senior examiner briefing, course or seminar arranged by the Brunei DCA. Content and duration will be determined by the Brunei DCA 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.

(c) 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 Brunei DCA.

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.

GM1 FCL.1015(a); FCL.1025(b)(2)

Examiner standardisation courses at an ATO or a DTO

In point FCL.1015(a) (second sentence) and in point FCL.1025(b)(2) (second sentence), the word ‘may’ is used indicate that completing an examiner standardisation course or an examiner refresher course at a DTO is an option which can be used by examiners for sailplanes and balloons as an alternative to completing such courses provided by the competent authority or an ATO (first sentence in both point FCL.1015(a) and point FCL.1025(b)(2)).

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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 EBT practical assessment, in AMC1 to Appendix 10;

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

GM1 FCL.1030(b)(ii) Conduct of skill tests, proficiency checks and assessment of competence

REVALIDATION OF CLASS AND TYPE RATINGS — AEROPLANES — REQUIRED MANOEUVRES AND EXERCISES IN THE CONTEXT OF APPENDIX 10 (EBT PRACTICAL ASSESSMENT)

The confirmation that all the required manoeuvres and exercises have been completed means that during the period of validity of the type rating, the applicant has completed the operator's EBT programme applicable to that period.

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APPENDICES

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.

(c) The UPRT elements and components specified in AMC2 to Appendix 3; AMC1 to Appendix 5 point (a) should be integrated into the flying training phases or modules.

(d) The flight instruction syllabus should take into account the principles of TEM.

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 Brunei DCA, 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, which also cover the Area 100 KSA, may include in suitable proportions:

(1) Classroom work;
(2) Lessons;
(3) Tutorials;
(4) Demonstrations, including those supported by demonstration equipment;
(5) Exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;
(6) Exercises that use demonstration equipment or training devices;
(7) Directed study including workbook exercises or assignments;
(8) Aerodrome or aviation industry filed trips;
(9) Computer-based training and e-learning elements;
(10) Progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) Other training methods, media and tools approved by the competent authority.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	35 hours
(2)	Aircraft general knowledge	100 hours
(3)	Flight performance and planning	120 hours
(4)	Human performance and limitations	35 hours
(5)	Meteorology	60 hours

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(6) Navigation 90 hours

(7) Operational procedures 25 hours

(8) Principles of flight 55 hours

(9) Communications 20 hours

Other subdivision of hours may be agreed upon between the Brunei DCA 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) the basic UPRT exercise as specified in point (b) of AMC2 to Appendix 3; AMC1 to Appendix 5;~~;~~

(vi) 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 navigation progress test conducted by an FI not connected with the applicant's training;

(iii) dual night flight instruction.

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(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 and the basic UPRT exercises as specified in Sections A, B, C and D of Table 2 in point (b) of AMC2 to Appendix; AMC1 to Appendix 5;

(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);

(vii) after completion of instrument training that is equivalent to the basic instrument flight module set out in AMC2 to Appendix 6, take-offs and landings as PIC at night.

(5) Phase 5: Advanced UPRT in accordance with point FCL.745.A;

(6) Phase 6:

(i) instruction and testing in MCC comprise the relevant training requirements;

(ii) if a type rating for single-pilot aeroplanes in multi-pilot operations, or multi-pilot aeroplanes is not required on completion of this phase, the applicant should be issued with a certificate of course completion for MCC training.

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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 may contain in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercises or assignments;

(8) aerodrome or aviation industry field trips;

(9) computer-based training and e-learning elements;

(10) progress tests, Area 100 KSA assessments and mental maths test(s); and

(11) other training methods, media and tools approved by the competent authority

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instruction, as required by ORA.ATO.305, may include all of the above except item (b)(9).

(c) The ATP modular course should be completed within 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 Brunei DCA, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

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Theoretical knowledge

(c) The 500 hours of instruction which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as a group or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercises or assignments;

(8) aerodrome or aviation industry field trips;

(9) computer-based training and e-learning elements;

(10) progress tests, Area 100 KSA assessments and mental math test(s); and

(11) other training methods, media and tools approved by the competent authority.

The 500 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	75 hours
(3)	Flight performance and planning	80 hours
(4)	Human performance and limitations	20 hours
(5)	Meteorology	40 hours
(6)	Navigation	55 hours
(7)	Operational procedures	15 hours
(8)	Principles of flight	35 hours
(9)	Communications	15 hours

Other subdivisions of hours may be agreed upon between the Brunei DCA 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) the basic UPRT exercises as specified in point (b) of AMC2 to Appendix 3; AMC1 to Appendix 5;

(vi) 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:

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(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 navigation progress test conducted by an FI not connected with the applicant's training;

(iii) dual night flight instrument.

(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 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 and the basic UPRT exercises as specified in Sections A, B, C and D of Table 2 in paragraph (b) of AMC2 to Appendix 3; AMC1 to Appendix5;

(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

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engine shut-down and restart. The latter exercise is to be conducted at a safe altitude unless carried out in an FSTD.

(vii) after completion of instrument training that is equivalent to the basic instrument flight module set out in AMC2 to Appendix 6, take-offs and landings as PIC at night.

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 Brunei DCA, an ATO may designate certain dual exercises to be flown in a helicopter up to a maximum of 20 hours.

Theoretical knowledge

(c) The 350 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercises or assignments;

(8) aerodrome or aviation industry field trips;

(9) computer-based training and e-learning elements;

(10) progress tests, Area 100 KSA assessments and mental maths test(s); and

(11) other training methods, media and tools approved by the competent authority.

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) the basic UPRT exercises as specified in point (b) of AMC2 to Appendix 3; AMC1 to Appendix 5;

(vi) 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:

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(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 30 hours instruction and at least 58 hours as PIC, including:

(i) 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;

(ii) 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;

(iii) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(iv) night flight time including, after completion of instrument training that is equivalent to the basic instrument flight module set out in AMC2 to Appendix 6, 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).

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E. CPL modular course: aeroplanes

(a) The CPL modular course should be completed within 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.

Crediting

Applicants with prior experience as PIC may be credited with an amount of hours to meet the requirement of 150 hours of flight time Appendix 3, Part E, point (3)(a). The amount of credited hours should be decided by the ATO where the applicant takes the training course on the basis of a pre-entry flight test, in any case, should have been completed only in one aircraft category other than aeroplane.

Theoretical knowledge

The 250 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportion:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstrations, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodromes or aviation industry field trips;
(9) computer-based training and e-learning elements;
(10) progress test, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instruction, as required by ORA.ATO.305, may include all of the above except item (b)(9).

Flying training

(c) 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: 0:45 hours
take-off, traffic pattern, approach and landing, use of checklist, collision avoidance and checking procedures.

(iii) Exercise 3: 0:45 hours
traffic patterns: simulated

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engine failure during and
after take-off.

(iv) Exercise 4: 1:00 hours
maximum performance
(short field and obstacle clearance)
take-offs and short-field landings.

(v) Exercise 5: 1:00 hours
crosswind take-offs,
landings and go-arounds.

(vi) Exercise 6: 0:45 hours
flight at relatively critical
high air speeds; recognition of
and recovery from spiral dives.

(vii) Exercise 7: 0:45 hours
flight at critically slow air speeds,
spin avoidance, recognition of
and recovery from incipient
and full stalls.

(viii) Exercise 8: 10:00 hours
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.

(2) instrument flight training:

(i) This module's content is identical to that of 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 basic UPRT exercises as specified in Sections A, B and C of Table 2 in point (b) of AMC2 Appendix 3; AMC1 Appendix 5.

(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) and (14).

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(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: 0:30 hours

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.

(vi) Exercise 10: 0:45 hours

Repetition of exercise 9; additionally climbing and descending, maintaining heading and speed, transition to horizontal flight; climbing and descending turns.

(vii) Exercise 11: 0:45 hours

Instrument pattern:

(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: 0:45 hours

Repetition of exercise 9 and steep turns with 45° bank; recovery from unusual attitudes.

(ix) Exercise 13: 0:45 hours

Repetition of exercise 12

(x) Exercise 14: 0:45 hours

Radio navigation using VOR, NDB or, if available, VDF; interception of predetermined QDM and QDR.

(xi) Exercise 15: 0:45 hours

Repetition of exercise 9 and recovery from unusual attitudes.

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(xii) Exercise 16: 0:45 hours
Repetition of exercise 9, turns and level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.

(xiii) Exercise 17: 0:45 hours
Recognition of, and recovery from, incipient and full stalls.

(xiv) Exercise 18: 3:30 hours
Repetition of exercises (14), (16) and (17).

(3) ME training

If required, operation of an ME aeroplane in the exercises 1 through 17, 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.

(4) Applicants who need to complete night training in accordance with point 10(b) of Section E of Appendix 3 to Part-FCL should perform take-offs and landings as PIC at night only after having completed the instrument flight training specified in point (2)(i) of 'FLYING TRAINING' of Section E of this AMC.

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 Brunei DCA, an ATO may designate certain dual exercises to be flown in an aeroplane up to a maximum of 20 hours.

Theoretical knowledge

(c) The 750 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercises or assignments;

(8) aerodrome or aviation industry field trips;

(9) computer-based training and e-learning elements;

(10) progress test, Area 100 KSA assessments and mental maths test(s); and

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(11) other training methods, media and tools approved by the competent authority.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	35 hours
(2)	Aircraft general knowledge	100 hours
(3)	Flight performance and planning	120 hours
(4)	Human performance and limitations	35 hours
(5)	Meteorology	60 hours
(6)	Navigation	90 hours
(7)	Operational procedures	25 hours
(8)	Principles of flight	55 hours
(9)	Communications	20 hours

Other subdivision of hours may be agreed upon between the Brunei DCA 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:

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

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

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

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

(5) 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;

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(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 BAR 1 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.

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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 Brunei DCA, 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, which also cover the area 100 KSA, may include in suitable proportions:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstration, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight an en-route planning, communications, presentation and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodrome or aviation industry field trips;
(9) computer-based training and e-learning;
(10) progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

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	90 hours
(3)	Flight performance and planning	90 hours
(4)	Human performance and limitations	30 hours
(5)	Meteorology	50 hours
(6)	Navigation	70 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	45 hours
(9)	Communications	15 hours

Other subdivision of hours may be agreed upon between the Brunei DCA 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;

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(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.

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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, which also covers the area 100 KSA, may contain in suitable proportions:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstration, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight an en-route planning, communications, presentation and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodrome or aviation industry field trips;
(9) computer-based training and e-learning;
(10) progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instruction, as required by ORA.ATO.305, may include all of the above except item (b)(9).

(c) The ATP modular course should be completed within 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 Brunei DCA, an ATO may designate certain dual exercises to be flown in an aeroplane up to a maximum of 20 hours.

Theoretical knowledge

(c) The 500 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstration, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight an en-route planning, communications, presentation and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodrome or aviation industry field trips;
(9) computer-based training and e-learning;
(10) progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

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The 500 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	75 hours
(3)	Flight performance and planning	80 hours
(4)	Human performance and limitations	20 hours
(5)	Meteorology	40 hours
(6)	Navigation	55 hours
(7)	Operational procedures	15 hours
(8)	Principles of flight	35 hours
(9)	Communications	15 hours

Other subdivision of hours may be agreed upon between the Brunei DCA 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;

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(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 Brunei DCA, an ATO may designate certain dual exercises to be flown in an aeroplane up to a maximum of 20 hours.

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Theoretical knowledge

(c) The 350 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstration, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight an en-route planning, communications, presentation and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodrome or aviation industry field trips;
(9) computer-based training and e-learning;
(10) progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

The 350 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	15 hours
(2)	Aircraft general knowledge	40 hours
(3)	Flight performance and planning	35 hours
(4)	Human performance and limitations	10 hours
(5)	Meteorology	30 hours
(6)	Navigation	35 hours
(7)	Operational procedures	10 hours
(8)	Principles of flight	30 hours
(9)	Communications	10 hours

Other subdivision of hours may be agreed upon between the Brunei DCA 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;

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(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 be completed within 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.

CREDITING

Applicants with prior experience as PIC may be credited with an amount of hours to meet the requirement of 150 hours of flight time of Appendix 3, Part K, point (3)(a).

The amount of credited hours should be decided by the ATO where the applicant takes the training course on the basis of a pre-entry flight test, but in any case, should have been completed only in one aircraft other than helicopter, and not be a combination of hours in more than two different aircraft categories.

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Theoretical knowledge

(b) The 250 hours of instruction, which also covers the Area 100 KSA may include in suitable proportions:

(1) classroom work;
(2) lessons;
(3) tutorials;
(4) demonstration, including those supported by demonstration equipment;
(5) exercises carried out as groups or individuals and based on pre-flight an en-route planning, communications, presentation and projects;
(6) exercises that use demonstration equipment or training devices;
(7) directed study including workbook exercises or assignments;
(8) aerodrome or aviation industry field trips;
(9) computer-based training and e-learning;
(10) progress tests, Area 100 KSA assessments and mental maths test(s); and
(11) other training methods, media and tools approved by the competent authority.

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instructions, as required by ORA.ATO.305, may include all of the above except item (b)(9).

Flying training

(c) 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

(d) 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.

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Basic instrument instruction

(e) 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).

AMC2 to Appendix 3; AMC1 to Appendix 5

BASIC UPRT FOR AEROPLANE ATP INTEGRATED, CPL/IR INTEGRATED, CPL INTEGRATED AND CPL MODULAR COURSES AS WELL AS MPL COURSE PHASES 1 TO 3

(a) BASIC UPRT ELEMENTS AND COMPONENTS

In order for student pilots to develop the competencies to prevent and recover from aeroplane upsets, the basic UPRT elements and respective components in the following Table 1 should be integrated into the flying training modules and phases, such that all the elements are covered.

Table 1: Basic UPRT elements and components		Pre-flight briefing	Flying training
A.	**Aerodynamics**		
1.	General aerodynamics characteristics	•	•
2.	Aeroplane certification and limitations	•	•
3.	Aerodynamics (high and low altitude)	•	
4.	Aeroplane performance (high and low altitude)	•	•
5.	AoA and stall awareness	•	•
6.	Aeroplane stability	•	•
7.	Control surface fundamentals	•	•
8.	Use of trim	•	•
9.	Icing and contamination effects	•	•
10.	Propeller slipstream (as applicable)	•	•
B.	**Causes of and contributing factors to upsets**		
1.	Environmental	•	
2.	Pilot-induced	•	
3.	Mechanical	•	
C.	**Safety review of accidents and incidents relating to aeroplane upsets**		
1.	Safety review of accidents and incidents relating to aeroplane upsets	•	
D.	**G-load awareness and management**		
1.	Positive/negative/increasing/decreasing G-loads	•	•
2.	Lateral G awareness (sideslip)	•	•
3.	G-load management	•	•
E.	**Energy management**		
1.	Kinetic energy vs potential energy vs chemical energy (power)	•	•

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F.	**Flight path management**		
1.	Relationship between pitch, power and performance	•	•
2.	Performance and effects of differing power plants	•	•
3.	Manual and automation inputs for guidance and control (if applicable)	•	•
4.	Class-specific characteristics of flight path management	•	•
5.	Management of go-arounds from various stages during the approach	•	•
6.	Automation management (if applicable)	•	•
7.	Proper use of rudder	•	•
G.	**Recognition**		
1.	Class-specific examples of physiological, visual and instrument clues during developing and developed upset	•	•
2.	Pitch/power/roll/yaw	•	•
3.	Effective scanning (effective monitoring)	•	•
4.	Stall protection systems and cues	•	•
5.	Criteria for identifying stalls and upsets	•	•
H.	**System malfunction** (including immediate handling and subsequent operational considerations, as applicable)		
1.	Flight control defects	•	•
2.	Engine failure (partial or full)	•	•
3.	Instrument failures	•	•
4.	Loss of reliable airspeed (training elements as per point (lb) of AMC2 ORA.ATO.125[1]).	•	•
5.	Automation failures	•	•
6.	Stall protection system failures, including icing alerting systems	•	•

(b) MANOEUVRE-BASED UPRT EXERCISES

The following Table 2 contains manoeuvre-based basic UPRT exercises.

Table 2: Manoeuvre-based basic UPRT exercises		Pre-flight briefing	Flying training
A.	**Timely and appropriate intervention**		
1.	Arresting divergence of the aeroplane from intended flight path	•	•
2.	Preventing flight at airspeeds inappropriate for the (intended flight) condition	•	•
3.	Avoiding spins	•	•
B.	**Flight path management**		
1.	Steep turns	•	•
2.	Slow flight (including flight at critically low airspeed)	•	•
3.	High airspeed (including flight at relatively high airspeed)	•	•
C.	**Application of OEM recommendations (if applicable) during developing upsets**		
1.	Nose-low attitudes at various bank angles	•	•
2.	Nose-low attitudes at various bank angles (including spiral dive)	•	•
D.	**Stall events in the following configurations**		
1.	Take-off configuration	•	•
2.	Clean configuration	•	•
3.	Landing configuration	•	•

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(c) INTEGRATION OF TEM, PILOT CORE COMPETENCIES, AND HUMAN FACTORS

Threat and Error Management (TEM), pilot competencies and human factors, as shown in the following Table 3 below, should be integrated into the flying training modules and phases as appropriate.

Table 3: Core elements and components of TEM, pilot competencies and human factors		Pre-flight briefing	Flying training
A.	**TEM**		
1.	TEM framework	•	•
2.	Recognition of threats and errors	•	•
3.	Management of threats and errors	•	•
4.	Countermeasures against threats and errors to prevent undesired aircraft states, including early intervention and, when necessary to prevent upsets, timely application of countermeasures to manage undesired aircraft states	•	•
B.	**Pilot Competencies, including CRM**		
1.	All elements listed in Table 1 of GM2 FCL.735.A	•	•
C.	**Human factors**		
1.	Instrument interpretation, active monitoring, checking	•	•
2.	Distraction, inattention, fixation, fatigue	•	•
3.	Human information processing, cognitive effects	•	•
4.	Perceptual illusions (visual or physiological) and spatial disorientation, effects of G-loads	•	•
5.	Stress, startle and surprise effect	•	•
6.	Intuitive and counter-intuitive behaviour	•	•

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GM1 to Appendix 3; Appendix 5

BASIC UPRT EXERCISES

(a) General

The training objective of the basic UPRT exercises is for the student to achieve competence in applying prevention and recovery techniques. In order to meet the training objectives, some UPRT exercises will involve operation at altitudes, speeds and g-loadings that are not required for other parts of the training course. When designing training courses, ATOs should ensure that the aircraft used for these exercises will allow the training objectives to be achieved while maintaining a margin of safety to aircraft limitations in accordance with the training envelope, as determined by the ATO (see GM1 ORA.ATO.125 point (f)).

(b) UPRT with reference to instruments

Basic UPRT exercises completed by reference to instruments (i.e. in simulated instrument meteorological conditions (IMC)) should involve only moderate excursions from the speeds and attitudes used in normal instrument flight. Exercises conducted in IMC should not be planned to involve 'unusual attitudes'.

(c) Instruction delivering basic UPRT

Instructors conducting basic UPRT training during the CPL or ATP course do not require any additional qualifications. It is the responsibility of the ATO to ensure that instructors are competent to deliver effective training on all parts of the course and also that they are competent to recover the aircraft in the event that a student erroneously conducts any UPRT exercise.

(d) Application of OEM recommendations during developing upsets

Stall recovery training exercises as well as nose-high and nose-low prevention training exercises use the recovery strategies recommended by the OEMs contained in Tables 1, 2 and 3 below.

Note: As OEM procedures always take precedence over the general strategies as recommended by the OEMs, ATOs should consult the OEM on whether any approved specific procedures are available prior to using the templates.

Refer to revision 3 of the Airplane Upset Prevention and Recovery Training Aid (AUPRTA) for a detailed explanation and rationale of nose-high and nose-low recovery strategies as recommended by the OEMs.

Table 1: Stall event recovery template

Pilot Flying (PF) Immediately do the following at first indication of a stall (aerodynamic buffeting, reduced roll stability and aileron effectiveness, visual or aural cues and warnings, reduced elevator (pitch) authority, inability to maintain altitude or arrest rate of descent, stick shaker activation (if installed) during any flight phases except at lift-off.		
1.	**AUTOPILOT – DISCONNECT (IF APPLICABLE)** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	
2.	**AUTOTHROTTLE – OFF (IF APPLICABLE)**	
3.	**(a) NOSE-DOWN PITCH CONTROL** Apply until stall warning is eliminated **(b) NOSE-DOWN PITCH TRIM** (as needed) (reduced the AoA whilst accepting the resulting altitudes loss.)	
4.	**BANK – WINGS LEVEL**	
5.	**POWER – ADJUST (**as needed) (thrust reduction for aeroplanes with underwing-mounted engines may be needed)	
6.	**SPEEDBRAKES/SPOILERS – RETRACT**	
7.	When airspeed is sufficiently increasing – **RECOVER** to level fight (Avoid the secondary	

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Table 2: Nose-high recovery strategy template		
Recognise and confirm the developing situation by announcing **'nose high'**		
Pilot Flying (PF)		
1.	**AUTOPILOT – DISCONNECT (IF APPLICABLE)** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	
2.	**AUTOTHROTTLE – OFF** (if applicable)	
3.	**APPLY** as much nose-down control input as required to obtain a nose-down pitch rate	
4.	**POWER – ADJUST** (if required)	
5.	**ROLL – ADJUST** (if required)	
6.	When airspeed is sufficiently increasing – **RECOVER** to level flight (Avoid the secondary stall due to premature recovery or excessive G-loading)	
NOTE: (1) Recovery to level flight may require use of pitch trim. (2) WARNING: Excessive use of pitch trim or rudder may aggravate the upset situation or may result in high structural loads.		

Table 3: Nose-low recovery strategy template		
Recognise and confirm the developing situation by announcing **'nose low'** (if the autopilot or autothrottle is responding correctly, it may not be appropriate to decrease the level of automation while assessing if the divergence is being stopped)		
Pilot Flying (PF)		
1.	**AUTOPILOT – DISCONNECT (if applicable)** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	
2.	**AUTOTHROTTLE – OFF** (if applicable)	
3.	**RECOVERY** from stall (if required)	
4.	**ROLL** in the shortest direction to wings level (It may be necessary to reduce the G-loading by applying forward control pressure to improve roll effectiveness)	
5.	**POWER** and **DRAG – ADJUST** (if required)	
6.	**RECOVER** to level flight (Avoid the secondary stall due to premature recovery or excessive G-loading)	
NOTE: (1) Recovery to level flight may require use of pitch trim. (2) WARNING: Excessive use of pitch trim or rudder may aggravate the upset situation or may result in high structural loads.		

Additional guidance

(e) Specific guidance on UPRT is available in the latest revision of ICAO Doc 10011 'Manual on Aeroplane Upset Prevention and Recovery Training'.

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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	Note 2
		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	Note 2
		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	Note 2

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		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	Note 2
		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	Note 2
		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 1: In this matrix, FSTD credits refer to helicopter FSTDs, if not mentioned otherwise.

Note 2: Total credits for the FSTDs used in the course are not provided in the tables as the FSTDs may be used in various combinations. The FSTD credits provided in the tables for the separate phases of the course are the maximum FSTD credits available for each phase.

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GM1 to Appendix 3 Example of grading system for practical flight training during ATP, CPL and MPL courses grading system

An ATPL/CPL/MPL grading system may be developed by using the grading system in GM3 FCL.735.A.

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 specific arrangement, pursuant to ORA.GEN.205, between an approved training organisation (ATO) and an operator for the multi-pilot licence (MPL) training should cover at least the following points:

(1) pre-entry requirements (including screening and selection);

(2) provision of the relevant documentation (operations manuals (Oms) and training manuals);

(3) design of the training programme;

(4) content of the operator conversion course;

(5) training effectiveness (e.g. continuous monitoring system, progress checks, etc.);

(6) provision of base training;

(7) graduate performance data feedback from the operator to the ATO;

(8) course evaluation and improvement; and

(9) alignment of the grading and assessment criteria.

The ATO and operator may use their Oms and training manuals to identify additional areas to be covered by the specific arrangement.

The following scheme should be applied:

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MPL TRAINING SCHEME

(a) The following scheme should be applied:

MPL Training Scheme

Phases of training		Training Items	Flight and simulated flight training media – Minimum level requirement		Ground training media
Adapted competency model	**Phase 4 – advanced** Type rating training covering the training content of Appendix 9 to BAR 1 Part-FCL within an airline-oriented environment	• TEM and CRM • Landing training • All weather • LOFT • Abnormal procedures • Normal procedures • Type-specific UPRT	Aeroplane: ME Multi-crew certified	6 to 12 take-offs and landings as PF (in accordance with point 11 of Appendix 5) One go-around with all engines operating (refer to GM1 to Appendix 9 (d)).	• E-learning • Part-task trainer • Class room
			FSTD FS level D or C + ATC simulation	PF / PM	
	Phase 3 – intermediate Application of multi-crew operations in a high performance ME turbine aeroplane	• TEM and CRM • LOFT • Abnormal procedures • Normal procedures • Multi-crew • Instrument flight • Non-type-specific UPRT	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 / PM	
	Phase 2 – basic Introduction of multi-crew operations and instrument flight	• TEM and CRM • PF/PM complement • IFR cross-country • Instrument flight • Night flight	Aeroplane: SE or ME	PF / PM	
			FSTD: FNPT II + MCC		
	Phase 1 – core flying skills Specific basic SP training	• TEM and CRM • VFR Cross-country • Solo flight • Basic instrument flight • Principles of flight • Cockpit procedures • Upset recovery in an aeroplane • Night flight	Aeroplane: SE or ME	PF	
			FSTD: FNPT I / BITD		

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Theoretical knowledge instruction

(e) The 750 hours of instruction, which also cover the Area 100 KSA, may include in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercise or assignments;

(8) aerodrome or aviation industry filed trips;

(9) computer-based training and e-learning elements;

(10) progress tests, Area 100 KSA assessments and mental maths test(s); and

(11) other training methods, media and tools approved by the competent authority.

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		

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	pertinent weather;	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	
(vii)	files an ATS flight plan (if required).	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 calculation.	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	

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(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 flight, including recognising and managing potential threats and errors.		
(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	

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	(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,	PF	
		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 of climb or cruise altitude;	PF	
	(ii)	selects and maintains the appropriate climb		

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	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 knowledge;	PF/PNF	
(ii)	demonstrates adequate route knowledge;	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	

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(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		

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		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

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	(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

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(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 shear segment; 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

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	(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,

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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.

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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;

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(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 readback, 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)

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(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;

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(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;

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(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

Table 4. Examples of individual and team countermeasures

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GM2 to Appendix 5 Assessment of student competency during take-off and landing training

The required level of competency of a student pilot is assessed by observing the following:

(a) application of knowledge;

(b) application of regulations and procedures;

(c) communication;

(d) aeroplane flight path management – automation;

(e) aeroplane flight path management – manual control;

(f) leadership and teamwork;

(g) problem-solving and decision-making;

(h) situational awareness (SA) and information management; and

(i) workload management.

The competencies referred to in points (b) and (e) are particularly relevant during the training. This means that the focus is on observing the student pilot performing take-offs and landings in accordance with the standard operating procedures (SOPs) and recommended techniques of the original equipment manufacturer (OEM).

The competencies elements and sub-elements stipulated in GM1 to Appendix 5 for take-off and landing provide additional guidance for instructors and student pilots.

Consistency and repeatability of all competencies above is achieve if the student pilot is able to perform at least three successive take-offs and landings demonstrating the required observable behaviours.

The take-off and landing training in an aeroplane should include at least one go-around. Due consideration should be given to environmental conditions when evaluating competency.

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AMC1 to Appendix 6 Modular training courses 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 instruction, which include the application of threat and error management (TEM), may include in suitable proportions:

(1) classroom work;

(2) lessons;

(3) tutorials;

(4) demonstrations, including those supported by demonstration equipment;

(5) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(6) exercises that use demonstration equipment or training devices;

(7) directed study including workbook exercises or assignments;

(8) aerodrome or aviation industry field trips;

(9) computer-based training and e-learning elements;

(10) progress tests; and

(11) other training methods, media and tools is approved by the competent authority.

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instruction, as required by ORA.ATO.305, may include all of the above except item (b)(9).

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AMC2 to Appendix 6 Modular training courses 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 external visual cues; 0:30 hours

(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;

(5) roll out on initial heading, maintain descent (500 ft/min) and new heading for 1 minute;

(6) transition to horizontal flight, 1000 ft below initial flight level;

(7) initiate go-around;

(8) climb at best rate of climb speed.

(h) Exercise 4:

Repetition of exercise 1 and steep turns with 45° bank; 0:45 hours

recovery from unusual attitudes.

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(i) Exercise 5:

Repetition of exercise 4. 0:45 hours

(j) Exercise 6:

(1) radio navigation using VOR, NDB 0:45 hours
or, if available, VDF;

(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:	

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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 hours required for the theoretical knowledge instruction for the IR following the competency-based training route should be divided between the subjects and include the application of threat and error management (TEM) as based on the ATO's systems course design and agreed upon between the competent authority and the ATO.

An approved course, which includes the application and threat and error management, may contain in suitable proportions:

(i) classroom work;

(ii) lessons;

(iii) tutorials;

(iv) demonstrations, including those supported by demonstration equipment;

(v) exercises carried out as groups or individuals and based on pre-flight and en-route planning, communications, presentations and projects;

(vii) directed study including workbook exercises or assignments;

(viii) aerodrome or aviation industry field trips;

(ix) computer-based training and e-learning elements;

(x) progress tests; and

(xi) other training methods, media and tools approved by the competent authority.

Approved distance-learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom instruction, as required by ORA.ATO.305, may include all of the above except item (a)(2)(ix).

(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).

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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 the Brunei DCA; or

(b) a national instrument rating issued by the Brunei DCA prior to the application of Part FCL; or

(c) an instrument rating issued in compliance with the requirements of Annex 1 to the Chicago Convention by a country other than the ; or

(d) an authorisation issued by the under BAR 1.

The amount of credit given should not exceed the amount of hours completed as instrument flight time

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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 the Brunei DCA; or

(b) a national instrument rating prior to the application of Part FCL; or

(c) an instrument rating in compliance with the requirements of Annex 1 to the Chicago Convention by a country other than the ; or

(d) an authorisation issued by a State under BAR 1.

The amount of credit given should not exceed the amount oh hours completed as instrument flight time.

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 country other than the ;

(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.

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AMC9 to Appendix 6 Modular training courses for the IR - RESERVED

Airships – RESERVED

GM1 to Appendix 6 Modular training courses for the IR

Aa. IR(A)(8)

The following elements may be used by the examiner for the applicant's verbal demonstration of knowledge:

(a) AIR LAW:

(1) explain the requirements for plus validity and privileges of instrument ratings;

(2) explain why a time check has to be completed before flight;

(3) describe the necessary action when an aircraft experiences a failure in communications;

(4) state the responsibility of the operator when unable to utilise the published departure procedures;

(5) explain when the omnidirectional method is used for departure;

(6) describe the solutions when omnidirectional procedures are not possible;

(7) justify the establishment of aircraft categories for the approach;

(8) state the minimum obstacle clearance provided by the minimum sector altitudes (MSAs) established for an aerodrome;

(9) describe the point of origin, shape, size, and subdivisions of the area used for MSAs;

(10) explain why a pilot should not descend below obstacle clearance altitude/height (OCA/H) without visual reference, which is established for precision approach procedures, non-precision approach procedures and visual (circling) procedures;

(11) translate the following acronyms into plain language: decision altitude (DA), decision height (DH), obstacle clearance altitude (OCA), obstacle clearance height (OCH), minimum decision altitude (MDA), minimum decision height (MDH), minimum obstacle clearance (MOC), decision altitude/height (DA/H), obstacle clearance altitude/height (OCA/H) and minimum decision altitude/height (MDA/H);

(12) explain the relationship between the following: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H and MDA/H;

(13) define the following terms: initial approach fix (IAF), intermediate fix (IF), final approach fix (FAF), missed approach point (MAPt) and turning point;

(14) state the accuracy of facilities providing track (omnidirectional radio range (VOR), instrument landing system (ILS), non-directional beacon (NDB));

(15) state the optimum descent gradient (preferred for a precision approach) in degrees and per cent;

(16) name the five standard segments of an instrument approach procedure and state the beginning and end for each of them;

(17) describe where an arrival (ARR) route normally ends;

(18) state whether or not omnidirectional or sector ARRs are possible to be made;

(19) explain the main task of the initial approach segment;

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(20) describe the main task of the intermediate approach segment;

(21) state the main task of the final approach segment;

(22) name the two possible aims of a final approach;

(23) explain the term ‘final approach point’ in case of an ILS approach;

(24) state what happens if an ILS glide path (GP) becomes inoperative during approach;

(25) describe the main task of a missed approach procedure;

(26) define ‘MAPt’;

(27) state the pilot’s reaction if upon reaching the MAPt, the required visual reference is not established;

(28) describe what a pilot is expected to do in the event that a missed approach is initiated prior to arriving at the MAPt (a missed approach, after an approach flown as CDFA, should be made when reaching the MAPt or DA/H, whichever occurs first);

(29) state whether the pilot is obliged to cross the MAPt at the A/H required by the procedure or whether they are allowed to cross the MAPt at an A/H greater than that required by the procedure;

(30) describe what is meant by ‘visual manoeuvring (circling)’;

(31) state the conditions to be fulfilled before descending below MDA/H in a visual manoeuvring (circling) approach;

(32) state how the pilot is expected to behave after initial visual contact during a visual manoeuvring (circling);

(33) describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach;

(34) describe the shape and terminology associated with the holding pattern;

(35) state the bank angle and rate of turn to be used whilst flying in a holding pattern;

(36) explain why pilots in a holding pattern should attempt to maintain tracks and how this is achieved;

(37) describe where outbound timing begins in a holding pattern;

(38) state where the outbound leg in a holding pattern terminates if the outbound leg is based on distance-measuring equipment (DME);

(39) describe the three entry headings for entries into a holding pattern;

(40) define the terms ‘parallel entry’, ‘offset entry’, and ‘direct entry’;

(41) determine the correct entry procedure for a given holding pattern;

(42) state the still-air time for flying on the outbound entry heading with or without DME;

(43) define the following Q codes: ‘QNH’ and ‘QFE’;

(44) define ‘flight level’ (FL);

(45) state the intervals by which consecutive FLs should be separated;

(46) describe how FLs are numbered;

(47) define the term ‘transition altitude’;

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(48) define the term ‘transition level’;

(49) state how the vertical position of the aircraft should be expressed at or below the transition altitude and transition level;

(50) define the term ‘transition layer’;

(51) state when the QNH altimeter setting should be made available to departing aircraft;

(52) state how a QNH altimeter setting should be made available to aircraft approaching a controlled aerodrome for landing;

(53) state where during the climb, the altimeter setting should be changed from QNH to 1013.2 hPa;

(54) describe when a pilot of an aircraft intending to land at an aerodrome should obtain the transition level;

(55) describe when a pilot of an aircraft intending to land at an aerodrome should obtain the actual QNH altimeter setting;

(56) state where the altimeter settings should be changed from 1013.2 hPa to QNH during descent for landing;

(57) state the modes and codes that the pilot should operate in the absence of any air traffic control (ATC) directions or regional air navigation agreements;

(58) state when the pilot should ‘squawk ident’;

(59) state the transponder mode and code to indicate: a state of emergency, a failure in communications, an unlawful interference;

(60) describe the consequences of an in-flight transponder failure;

(61) state the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at that aerodrome is possible;

(62) understand the various rules and services that apply to the various classes of airspace;

(63) describe the aim of clearances issued by the ATC with regard to instrument flight rules (IFR), visual flight rules (VFR) or special VFR flights, and refer to the different airspaces;

(64) explain what is meant by the expression ‘clearance limit’;

(65) explain the meaning of the phrases ‘cleared via flight planned route’, ‘cleared via (designation) departure’ and ‘cleared via (designation) ARR’ in an ATC clearance;

(66) list which items of an ATC clearance should always be read back by the flight crew;

(67) justify the speed control by the ATC;

(68) explain how the change from IFR to VFR may be initiated by the pilot in command (PIC);

(69) define the following terms: ‘transition level’, ‘transition layer’, and ‘transition altitude’;

(70) indicate how the vertical position of an aircraft in the vicinity of an aerodrome should be expressed at or below the transition altitude, at or above the transition level, and while climbing or descending through the transition layer;

(71) list the six items that are normally included in a voice position report;

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(72) name the item of a position report which must be forwarded to the ATC with the initial call after changing to a new frequency;

(73) understand the difference among the types of separation within the various classes of airspace and among the various types of flight;

(74) state who is responsible for the avoidance of collision with other aircraft when operating in visual meteorological conditions (VMC);

(75) explain the term 'expected approach time' and the procedures for its use;

(76) state the reasons which may probably lead to the decision to use another take-off or landing direction than the one into the wind;

(77) define the term 'radar vectoring';

(78) explain the procedures for the conduct of surveillance radar approaches (SRAs);

(79) state the mode and code of secondary surveillance radar (SSR) equipment that a pilot may operate in a (general) state of emergency, or (specifically) in case the aircraft is subject to unlawful interference;

(80) describe the expected action of the aircraft after receiving a broadcast from air traffic services (ATS) concerning the emergency descent of another aircraft;

(81) name the colours used for the various markings (runway (RWY), taxiway (TWY), aircraft stands, apron safety lines);

(82) describe the application and characteristics of RWY centre line markings and threshold markings;

(83) describe the wing bars of a precision approach path indicator (PAPI) and an abbreviated precision approach path indicator (A-PAPI); and

(84) interpret what the pilot sees during approach, using a PAPI, an APAPI, a T visual approach slope indicating system (TVASIS), and an abbreviated T visual approach slope indicator system (ATVASIS);

(b) FLIGHT PLANNING AND FLIGHT MONITORING:

(1) select the preferred airway(s) or route(s) considering:

(i) altitudes and FLs,

(ii) standard routes,

(iii) ATC restrictions,

(iv) the shortest distance,

(v) obstacles, and

(vi) any other relevant data;

(2) determine courses and distances from en route charts;

(3) determine bearings and distances of waypoints based on radio navigation aids on en route charts;

(4) define the following altitudes:

(i) minimum en route altitude (MEA),

(ii) minimum obstacle clearance altitude (MOCA),

(iii) minimum off-route altitude (MORA),

(iv) grid minimum off-route altitude (Grid MORA),

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(v) maximum authorised altitude (MAA),

(vi) minimum crossing altitude (MCA), and

(vii) minimum holding altitude (MHA);

(5) extract the following altitudes from the chart(s):

(i) MEA,

(ii) MOCA,

(iii) MORA,

(iv) Grid MORA,

(v) MAA,

(vi) MCA, and

(vii) MHA;

(6) explain the reasons for studying standard instrument departure (SID) and standard ARR (STAR) charts;

(7) state the reasons why the SID and STAR charts show procedures only in a pictorial presentation style which is not to scale;

(8) interpret all data and information represented on SID and STAR charts, particularly:

(i) routings,

(ii) distances,

(iii) courses,

(iv) radials,

(v) altitudes/levels,

(vi) frequencies, and

(vii) restrictions;

(9) identify SIDs and STARs which may be relevant to a planned flight;

(10) state the reasons why it is imperative to be familiar with instrument approach procedures and appropriate data for departure, destination, and alternate airfields prior to departure;

(11) select instrument approach procedures appropriate for departure, destination, and alternate airfields;

(12) interpret all procedures, data and information represented on instrument approach charts, particularly:

(i) courses and radials,

(ii) distances,

(iii) altitudes, levels or heights,

(iv) restrictions,

(v) obstructions,

(vi) frequencies,

(vii) speeds and times,

(viii) DA/Hs and MDA/H,

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(ix) visibility and runway visual ranges (RVRs), and

(x) approach light systems;

(13) find communications (COM) frequencies and call signs for the following:

(i) control agencies, service facilities, and flight information services (FISs),

(ii) weather information stations, and

(iii) automatic terminal information service (ATIS);

(14) find the frequency and/or identifiers of radio navigation aids;

(15) complete the navigation plan with the courses, distances, and frequencies taken from charts;

(16) find standard instrument departure and ARR routes to be flown or to be expected;

(17) determine the position of top of climb (TOC) and top of descent (TOD), considering appropriate data;

(18) determine variation and calculate magnetic/true courses;

(19) calculate true airspeed (TAS) according to given aircraft performance data, altitude, and outside air temperature (OAT);

(20) calculate wind correction angles (WCA)/drift and ground speeds (GSs);

(21) determine all relevant altitudes/levels, particularly MEA, MOCA, MORA, MAA, MCA, MRA, and MSA;

(22) calculate individual and accumulated times for each leg until destination and alternate airfields;

(23) convert between volume, mass, and density given in different units commonly used in aviation;

(24) determine relevant data from the flight manual, such as fuel capacity, fuel flow/consumption at different power/thrust settings, altitudes, and atmospheric conditions;

(25) calculate attainable flight time/range considering fuel flow/consumption and available amount of fuel;

(26) calculate the required fuel considering fuel flow/consumption and required time/range to be flown;

(27) calculate the required fuel for an IFR flight considering expected meteorological conditions and expected delays under defined conditions;

(28) find and analyse the latest state at the departure, destination, and alternate aerodromes, in particular with regard to:

(i) opening hours,

(ii) work in progress (WIP),

(iii) special procedures due to WIP,

(iv) obstructions, and

(v) changes of frequencies for COM, navigation aids, and facilities;

(29) find and analyse the latest en route state with regard to:

(i) airway(s) or route(s),

(ii) restricted, dangerous, and prohibited areas, and

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(iii) changes of frequencies for COM, navigation aids, and facilities;

(30) state the reasons for a fixed format of an International Civil Aviation Organization (ICAO) air traffic services flight plan (ATS FPL);

(31) determine the correct entries to complete an FPL, as well as decode and interpret the entries in a completed FPL, particularly as regards the following:

(i) aircraft identification (Item 7),

(ii) flight rules and type of flight (Item 8),

(iii) number and type of aircraft and wake turbulence category (Item 9),

(iv) equipment (Item 10),

(v) departure aerodrome and time (Item 13),

(vi) route (Item 15),

(vii) destination aerodrome, total estimated elapsed time, and alternate aerodrome (Item 16),

(viii) other information (Item 18), and

(ix) supplementary information (Item 19);

(32) complete the FPL using information from the following:

(i) navigation plan,

(ii) fuel plan, and

(iii) operator's records on basic aircraft information;

(33) explain the requirements for the submission of an ATS FPL;

(34) explain the action to be taken in case of FPL changes;

(35) state the action to be taken in case of inadvertent changes to track, TAS, and time estimate, affecting the current FPL; and

(36) explain the procedures for closing an FPL;

(c) METEOROLOGY:

(1) describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value of 0.65 °C/100 m or 2 °C/1 000 ft and actual values);

(2) explain the characteristics of inversions and of an isothermal layer;

(3) explain the cooling and warming of the air on the earth or sea surfaces;

(4) describe qualitatively the influence of the clouds on the cooling and warming of the earth or sea surfaces as well as of the air near those surfaces;

(5) explain the influence of the wind on the cooling and warming of the air near the earth or sea surfaces;

(6) define 'atmospheric pressure';

(7) list the units of measurement of atmospheric pressure used in aviation (hPa, in.);

(8) describe isobars on the surface weather charts;

(9) explain the pressure variation with height;

(10) 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, whereas at about 5 500 m above mean sea level (AMSL) is 50 ft (15 m) per 1 hPa;

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(11) describe and interpret contour lines (isohypses) on a constant pressure chart;

(12) describe the relationship between pressure, temperature, and density;

(13) describe the vertical variation of the air density in the atmosphere;

(14) describe the effect of humidity changes on the air density;

(15) explain the use of standardised values for the international standard atmosphere (ISA);

(16) list the main values of ISA (mean sea level pressure, mean sea level temperature, a vertical temperature lapse rate up to 20 km, as well as height and temperature of the tropopause);

(17) calculate the standard temperature in Celsius degrees for a given FL;

(18) determine a standard temperature deviation based on the difference between the given OAT and the standard temperature;

(19) define the following terms and acronyms and explain how they are related to each other: H, A, pressure A, FL, pressure level, true A, true H, elevation, QNH, QFE, and standard altimeter setting;

(20) describe the following terms: transition A, transition level, transition layer, terrain clearance, and lowest usable FL;

(21) calculate the different readings on the altimeter when the pilot changes the altimeter setting;

(22) illustrate with a numbered example the changes of the altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level;

(23) derive the reading of the altimeter of an aircraft on the ground when the pilot uses different settings;

(24) explain the influence of the air temperature on the distance between the ground and the level reading on the altimeter as well as between two FLs;

(25) explain the influence of pressure areas on the true altitude;

(26) determine the true A/H for a given A/H and a given ISA temperature deviation;

(27) describe why and how the wind changes direction and speed with H in the friction layer in the northern and southern hemisphere (rule of thumb);

(28) describe and explain the origin and formation of mountain waves;

(29) explain how mountain waves may be identified through their associated meteorological phenomena;

(30) describe turbulence and gustiness;

(31) list common types of turbulence (convective, mechanical, orographic, frontal, and clearair turbulence);

(32) indicate the sources of atmospheric humidity;

(33) define ‘dew point’;

(34) define ‘relative humidity’;

(35) describe the relationship between temperature and dew point;

(36) estimate the relative humidity of the air based on the difference between dew point and temperature;

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(37) explain the influence of relative humidity on the H of the cloud base;

(38) list cloud types typical for stable and unstable air conditions;

(39) identify by shape cirriform, cumuliform, and stratiform clouds;

(40) explain the influence of inversions on vertical movements in the atmosphere;

(41) name the factors contributing in general to the formation of fog and mist;

(42) name the factors contributing to the formation of haze;

(43) describe significant characteristics of orographic fog;

(44) summarise the conditions for the dissipation of orographic fog;

(45) list and describe the types of precipitation given in the aerodrome forecast (TAF) and aerodrome routine meteorological report (METAR) codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, and freezing rain);

(46) assign typical precipitation types and intensities to different clouds;

(47) describe the boundaries between air masses (fronts);

(48) define ‘front’ and ‘frontal surface’ (‘frontal zone’);

(49) define ‘warm front’;

(50) describe the cloud, weather, ground visibility, and aviation hazards at a warm front depending on the stability of the warm air;

(51) explain the seasonal differences in the weather at warm fronts;

(52) describe the structure, slope, and dimensions of a warm front;

(53) define ‘cold front’;

(54) explain the seasonal differences in the weather at cold fronts;

(55) describe the structure, slope, and dimensions of a cold front;

(56) describe the cloud, weather, ground visibility, and aviation hazards in a warm sector;

(57) describe the cloud, weather, ground visibility, and aviation hazards behind the cold front;

(58) define the term ‘occlusion’;

(59) identify the typical flat pressure pattern on a surface weather chart;

(60) describe the weather associated with a flat pressure pattern;

(61) explain the general weather conditions under which ice accretion on airframe occurs;

(62) indicate in which circumstances ice may form on an aircraft on the ground: air temperature, humidity, precipitation;

(63) explain in which circumstances ice may form on an aircraft in flight: inside clouds, in precipitation, outside clouds, and in the absence of precipitation;

(64) 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.);

(65) define ‘clear ice’;

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(66) define ‘rime ice’;

(67) define ‘hoar frost’;

(68) state the ICAO qualifying terms for the intensity of icing;

(69) describe in general the hazards of icing;

(70) assess the dangers of the different types of ice accretion;

(71) state the ICAO qualifying terms for the intensity of turbulence;

(72) describe the effects of turbulence on an aircraft in flight;

(73) indicate the possibilities of avoiding turbulence

(i) in the flight planning: weather briefing, choice of track, and altitude, and

(ii) during flight: choice of appropriate track and altitude;

(74) define ‘wind shear’ (vertical and horizontal);

(75) describe the conditions in which wind shear forms and how it forms (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, and relief);

(76) describe the effects of wind shear on flight;

(77) indicate the possibilities of avoiding wind shear in flight:

(i) in the flight planning, and

(ii) during flight;

(78) name the cloud types which indicate the development of thunderstorms;

(79) describe the different types of thunderstorms, their location, the conditions for and the process of their development, and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms);

(80) assess the average duration of thunderstorms and their different stages;

(81) summarise the flight hazards of a fully developed thunderstorm;

(82) describe and assess ‘St. Elmo’s fire’;

(83) describe the effect of lightning strike on aircraft and flight execution;

(84) describe practical examples of flight techniques used to avoid the hazards of thunderstorms;

(85) describe the influence of a mountainous terrain on cloud and precipitation;

(86) describe the effects of the foehn;

(87) describe the influence of a mountainous area on a frontal passage;

(88) indicate the turbulent zones (mountain waves, rotors) on a sketch of a mountain chain;

(89) describe the reduction of visibility caused by precipitation (drizzle, rain, and snow);

(90) 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; (91) define ‘ground visibility’;

(92) list the units used for visibility (m, km); (93) define ‘RVR’; (94) list the units used for RVR (m); (95) compare visibility and RVR; (96) define ‘ceiling’; (97) name the unit and the reference level used for information about the cloud base (ft); (98) define ‘vertical visibility’; (99) name the unit used for vertical visibility (ft);

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(100) interpret ground-weather radar images;

(101) describe the basic principle of airborne weather radars as well as the type of information they provide;

(102) describe the limits and errors of airborne weather radar information;

(103) interpret typical airborne weather radar images;

(104) decode and interpret significant weather charts (low-, medium-, and high-level charts);

(105) describe the flight conditions at designated locations or along a defined flight route at a given FL, based on a significant weather chart;

(106) describe, decode (by using a code table), and interpret the following aviation weather messages (given in written or graphical format):

(i) METAR;

(ii) aerodrome special meteorological reports (SPECI);

(iii) trend forecast (TREND);

(iv) TAF;

(v) information concerning en route weather phenomena which may affect the safety of aircraft operations (SIGMET);

(vi) information concerning en route weather phenomena which may affect the safety of low-level aircraft operations (AIRMET);

(vii) area forecast for low-level flights (GAMET);

(viii) automatic terminal information service (ATIS);

(ix) meteorological information for aircraft in flight (VOLMET);

(x) special air-report, and

(xi) volcanic-ash advisory information;

(107) list in general the cases where a SIGMET and an AIRMET are issued; and

(108) describe, decode (by using a code table), and interpret the following messages: runway state message (as written in a METAR) and general aviation forecast (GAFOR).

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AMC1 to Appendix 7 IR skill test

LAPL, PPL, CPL, IR skill test and proficiency check application and report form

APPLICATION AND REPORT FORM			
LAPL, PPL, CPL, IR SKILL TEST AND PROFICIENCY CHECK			
Applicant's last name(s):			
Applicant's first name(s):			
Signature of applicant:			**LAPL: A ☐ H ☐** **PPL: A ☐ H ☐** **CPL: A ☐ H ☐** **IR: A ☐ H ☐**
Type of licence*:			
Licence number*:			
State:			
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

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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.

<table>
<tr><td colspan="6">APPLICATION AND REPORT FORM</td></tr>
<tr><td colspan="6">ATPL, MPL, TYPE RATING, TRAINING, SKILL TEST AND PROFICIENCY CHECK AEROPLANES (A) AND HELICOPTERS (H)</td></tr>
<tr><td colspan="2">Applicant’s last name(s):</td><td rowspan="2"><u>Aircraft:</u></td><td colspan="2">SE-SP: A ☐ H ☐</td><td>ME-SP: A ☐ H ☐</td></tr>
<tr><td colspan="2">Applicant’s first name(s):</td><td colspan="2">SE-MP: A ☐ H ☐</td><td>ME-MP: A ☐ H ☐</td></tr>
<tr><td colspan="2">Signature of applicant:</td><td><u>Operations:</u></td><td colspan="3">SP ☐ MP ☐</td></tr>
<tr><td colspan="2">Type of licence held:</td><td rowspan="4"><u>Checklist:</u></td><td colspan="2">Training record: ☐</td><td>Type rating: ☐</td></tr>
<tr><td colspan="2" rowspan="2">Licence number:</td><td colspan="2">Skill test: ☐</td><td>Class rating: ☐</td></tr>
<tr><td colspan="2" rowspan="2">State of licence issue:</td><td colspan="2">IR: ☐</td><td></td></tr>
<tr><td colspan="3">Proficiency check: ATPL: ☐ MPL: ☐</td></tr>
<tr><td>1</td><td colspan="5">Theoretical training for the issue of a type or class rating performed during period</td></tr>
<tr><td colspan="2">From:</td><td colspan="2">To:</td><td colspan="2">At:</td></tr>
<tr><td colspan="2">Mark obtained:</td><td colspan="2">% (Pass mark 75%):</td><td colspan="2">Type and number of licence:</td></tr>
<tr><td colspan="3">Signature of HT:</td><td colspan="3">Name(s) in capital letters:</td></tr>
<tr><td>2</td><td colspan="5">FSTD</td></tr>
<tr><td colspan="2">FSTD (aircraft type):</td><td colspan="2">Three or more axes:
Yes ☐
No ☐</td><td colspan="2">Ready for service and used:</td></tr>
<tr><td colspan="2">FSTD manufacturer:</td><td colspan="2">Motion or system:</td><td colspan="2">Visual aid: Yes ☐ No ☐</td></tr>
<tr><td colspan="4">FSTD operator:</td><td colspan="2">FSTD ID code:</td></tr>
<tr><td colspan="3">Total training time at the controls:</td><td colspan="3">Instrument approaches at aerodromes to a decision altitude or height of:</td></tr>
<tr><td colspan="3">Location, date and time:</td><td colspan="3">Type and number of licence:</td></tr>
<tr><td colspan="6">Type rating instructor ☐ Class rating instructor ☐ …… instructor ☐</td></tr>
<tr><td colspan="3">Signature of instructor:</td><td colspan="3">Name(s) in capital letters:</td></tr>
<tr><td>3</td><td colspan="5">Flight training: in the aircraft ☐ in the FSTD (for ZFTT) ☐</td></tr>
<tr><td colspan="2">Type of aircraft:</td><td colspan="2">Registration:</td><td colspan="2">Flight time at the controls:</td></tr>
</table>

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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.

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GM1 to Appendix 9 Training, skills test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

Type specific UPRT and go-around training in FSTD

(a) General

(1) The upset recovery training exercises should be mainly manoeuvre-based but may include some scenario-based training elements. The manoeuvre-based training enables type rating applicants to apply their handling skills and recovery strategy whilst leveraging CRM principles to return the aeroplane from an upset condition to a stabilised flight path.

(2) If training is conducted in an FSTD, it is important that applicants understand the limitations of the FSTD in replicating the physiological and psychological aspects of upset recovery exercises.

Note: In order to avoid negative training and negative transfer of training, the ATO should ensure that the selected upset recovery exercises take into consideration the limitations of the FFS.

(b) Stall event recovery in FSTD (Appendix 9, Section B(5) exercise 7.2.1; Section B(6) exercise 3.7.1)

(1) It is of utmost importance that stall event recovery training takes into account the capabilities of the FFS used. To deliver stall event recovery training, the FFS should be qualified against the relevant UPRT elements of CS-FSTD Issue 2. Stall event recovery training should include training up to the stall (approach-to-stall). Post-stall training may be delivered provided the device has been qualified against the relevant optional elements of CS-FSTD Issue 2 and the operator demonstrates that negative training or negative transfer of training is avoided. A ‘stall event’ is defined as an occurrence whereby the aeroplane experiences one or more conditions associated with an approach-to-stall or a post stall.

(2) Stall event recovery training should emphasise the requirement to reduce the AoA whilst accepting the resulting altitude loss. High-altitude stall event training should be included so that flight crew experience the aeroplane control response, the significant altitude loss during the recovery, and the increased time required to recover. The training should also emphasise the risk of triggering a secondary stall event during the recovery.

(3) Recovery from a stall event should always be conducted in accordance with the stall event recovery procedures of the OEMs.

Note: If an OEM-approved recovery procedure does not exist, ATOs should develop and train the aeroplane-specific stall recovery procedure based on the template in Table 1 below. Refer to Revision 3 of the Airplane Upset Prevention and Recovery Training Aid (AUPRTA) for a detailed explanation and rationale of the stall event recovery template as recommended by the OEMs.

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Table 1: Recommended stall event recovery template

Stall event recovery template		
Pilot Flying (PF) Immediately do the following at first indication of a stall (aerodynamic buffeting, reduced roll stability and aileron effectiveness, visual or aural cues and warnings, reduced elevator (pitch) authority, inability altitude or arrest rate of descent, stick shaker activation (if installed) during any flight phases except at *lift-off*		**Pilot Monitoring (PM)**
1.	**AUTOPILOT – DISCONNECT** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	**MONITOR** airspeed and attitude throughout the recovery and **ANNOUNCE** any continued divergence
2.	**AUTOTHRUST/AUTOTHROTTLE – OFF**	
3.	**(a) NOSE-DOWN PITCH CONTROL** Apply until stall warning is eliminated **(b) NOSE-DOWN PITCH TRIM** (as needed) (reduce the AoA whilst accepting the resulting altitude loss.)	
4.	**BANK – WINGS LEVEL**	
5.	**ROLL – ADJUST** (as needed) (Thrust reduction for aeroplanes with underwing-mounted engines may be needed)	
6.	**SPEEDBRAKES/SPOILERS – RETRACT**	
7.	When airspeed is sufficiently increasing - RECOVER to level flight (Avoid the secondary stall due to premature recovery or excessive G-loading)	

(c) Nose-high and nose-low recovery exercises (Appendix 9, Section B(5) exercise 7.2.2; B(6) exercise 3.7.2)

Nose-high and nose-low recovery exercises should be conducted in accordance with the strategies recommended by the OEMs contained in Tables 2 and 3 below.

Note: As the OEM procedures always take precedence over the recommendations, ATOs should consult the OEM on whether any approved type-specific recovery procedures are available prior to using the templates.

Refer to Revision 3 of the Airplane Upset Prevention and Recovery Training Aid (AUPRTA) for a detailed explanation and rationale of nose-high and nose-low recovery strategies as recommended by the OEMs.

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Table 2: Recommended nose-high recovery strategy template

Nose-high recovery strategy template		
Either pilot – Recognise and confirm the developing situation by announcing '**nose high'**		
	PF	**PM**
1.	**AUTOPILOT – DISCONNECT** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	**MONITOR** airspeed and attitude throughout the recovery and **ANNOUNCE** any continued divergence
2.	**AUTOTHRUST/AUTOTHROTTLE – OFF**	
3.	APPLY as much nose-down control input as required to obtain a nose-down pitch rate	
4.	**THRUST – ADJUST** (if required) (Thrust reduction for aeroplanes with underwing-mounted engines may be needed)	
5.	**ROLL – ADJUST** (if required) (Avoid exceeding 60-degree bank)	
6.	When airspeed is sufficiently increasing – **RECOVER** to level flight (Avoid the secondary stall due to premature recovery or excessive G-loading)	
Note: (1) Recovery to level flight may require use of pitch trim. (2) If necessary, consider reducing thrust in aeroplanes with underwing-mounted engines to aid in achieving nose-down pitch rate. (3) **WARNING:** Excessive use of pitch trim or rudder may aggravate the upset situation or may result in high structural loads.		

Table 3: Recommended nose-low recovery strategy template

Nose-low recovery strategy template		
Either pilot – Recognise and confirm the developing situation by announcing '**nose low'** (if the autopilot or autothrust/autothrottle is responding correctly, it may not be appropriate to decrease the level of automation while assessing if the divergence is being stopped)		
	PF	**PM**
1.	**AUTOPILOT – DISCONNECT** (A large out-of-trim condition could be encountered when the autopilot is disconnected)	**MONITOR** airspeed and attitude throughout the recovery and **ANNOUNCE**
2.	**AUTOTHRUST/AUTOTHROTTLE – OFF**	
3.	RECOVERY from stall if required	
4.	**ROLL** in the shortest direction to wings level (It may be necessary to reduce the G-loading by applying forward control pressure to improve roll effectiveness)	
5.	**THRUST** and **DRAG – ADJUST** (if required)	
6.	**RECOVER** to level flight (Avoid the secondary stall due to premature recovery or excessive G-loading.)	
Note: (1) Recovery to level flight may require use of pitch trim. (2) **WARNING:** Excessive use of pitch trim or rudder may aggravate the upset situation or may result in high structural loads.		

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(d) Go-around with all engines operating from various stages during an instrument approach (Appendix 9, Section B(5) exercise 7.3; B(6) exercise 4.1.)

(1) The objective of the go-around exercises is to expose the student pilot to the physiological effects caused by a go-around. The instructor should ensure that student pilots understand the objective of the exercises and provide students with appropriate coping strategies, including TEM. Due consideration should be given to environmental conditions when evaluating the demonstration of task proficiency and related criteria.

(2) A go-around may be commenced at any time during an approach, including before the aeroplane is in the landing configuration. Historically, most go-around training has been conducted when the aeroplane is in the landing configuration prior to commencing the go-around. Students must be prepared to adapt the go-around manoeuvre if the go- around is commenced prior to the point where the aeroplane is fully configured for landing. Situation awareness in relation to flap and gear configuration, aeroplane speed and missed approach altitude is important.

(3) Unanticipated go-arounds may startle the students (e.g. unexpected ATC constraints, automation malfunction, adverse weather, etc.). Students may find themselves faced with a situation where they have to perform a large number of critical actions under a high workload (e.g. setting thrust, landing gear retraction, flight path management). The instructor should explain that there is also a possibility of disorientation during a go- around because of the somatogravic effect produced by large longitudinal acceleration felt by the inner-ear as the aeroplane speed increases. This effect cannot be reproduced in an FSTD.

(4) It is vital that the correct pitch attitude is selected and maintained, while the aeroplane is kept in trim as it accelerates (depending on the aeroplane type). On some aeroplane types with under-slung engines the pitch response with all engines functioning may be amplified due to the relatively low gross weight towards the end of a flight and the high thrust available from modern aeroplane engines. It is particularly important that trim changes are anticipated on such aeroplanes.

(5) ATOs should develop scenarios for go-around training containing different take-off and approach stall situations that also involve surprise and startle effects and include:

(i) a go-around from the non-landing configuration;

(ii) a go-around at low gross weight using maximum go-around thrust;

(iii) a go-around from the outer marker or equivalent point;

(iv) a go-around below 500 ft using, as applicable/permitted, reduced go-around thrust;

(v) a go-around initiated above the published missed approach altitude; and

(vi) a normal go-around from the landing configuration using reduced go-around thrust (if available / type-specific).

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(6) Training should also incorporate topics such as flight path management (manual and automatic), application of procedures, startle factors, communication, workload management and situation awareness. The objective of this training is to highlight:

(i) differences to procedures when the aircraft is in the non-landing configuration;

(ii) differences in handling characteristics at low gross weights and high thrust settings;

(iii) the threat associated with go-arounds close to the published missed approach altitudes;

(iv) startle and surprise associated with an unplanned go-around (ATC, blocked runway, etc.);

(v) the importance of effective communication between flight crew;

(vi) the requirement to be aware of the aircraft energy state during a go-around; and

(vii) the importance of engaging the autopilot or flight director in the correct modes during a go-around.

(7) Go-around training should not be limited to addressing the somatogravic effects caused by a go-around. Training should also cover topics such as flight path management (manual and automatic), application of procedures, startle factor, communication, workload management and situation awareness. Flight path management training should address:

(i) the handling differences of a lighter than normal aircraft which may differ to handling experienced during take-off when the aircraft is much heavier;

(ii) the different reaction of the aeroplane (pitch and vertical speed) comparing a go- around performed with reduced G/A thrust (if the function is available) and a go- around performed with full G/A thrust (a different weight).

(8) The importance of correct selection of TO/GA modes by the PF should also be emphasised (pushing TO/GA, selected the correct thrust lever detent, etc.)

(9) The importance of the PM role in the go-around manoeuvre should also be highlighted. The PM usually has higher workload as they need to reconfigure the aircraft, engage FMA modes, communicate with ATC and monitor the actions of the PF. This excessive workload for the PM may lead him or her to prioritise actions to the detriment of monitoring activities. The phenomenon of attentional tunnelling may also need to be addressed. This happens when one pilot, or both, focus exclusively on a problem at the expense of general monitoring of the flight parameters.

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AMC1 to Appendix 10 – Revalidation and renewal of type ratings, and revalidation and renewal of IRs when combined with the revalidation or renewal of type ratings – EBT practical assessment

APPLICATION AND REPORT FORM – ADMINISTRATIVE PROCEDURES RELATED TO TYPE RATINGS

(a) Minimum information provided in the form for Appendix 10.

Applicant's last name(s):	Applicant's first name:
Signature of applicant:	State of licence issue:
Type of licence held:	Licence number:
Type rating:	FSTD (aircraft type):

EBT Module 1	Session 1…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session 2…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session X…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Completion of the module: _____ ☐ date / signature (EBT manager)
EBT Module 2	Session 1…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session 2…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session X…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Completion of the module: _____ ☐ date / signature (EBT manager)
EBT Module X	Session X…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session Y…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Session Z…… Name of the instructor: _____ Type and number of licence: _____ Location, date and time: _____ FSTD ID Code: _____
	Completion of the module: _____ ☐ date / signature (EBT manager)

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Completion of the operator's EBT programme from _____ (date) to _____ (date) ☐	Date / signature (EBT manager)
Name(s) in capital letters: Type and number of licence: Examiner certificate number:	Signature of examiner (EBT manager) Date of applicant's licence endorsement: _____
Delegation of signature for licence endorsement (instructor)	
Name: Position in the operator: Date:	Signature:

(b) AOC declaration for revalidation and renewal under the EBT programme for the purpose of AMC1 ARA.GEN.315(a) point (d) and for the purpose of point 1(a) of Appendix 10.

I confirm all of the following:

The EBT manager holds a current type rating examiner certificate in the type rating filled in in Appendix 10 (copy to be attached);	Yes ☐
The instructor(s) that conducted the training to the applicant has (have) been standardised.	Yes ☐
The EBT operator has performed a verification of the grading system at least once in the last 3 years.	Yes ☐
The integrity of the applicant training data is ensured.	Yes ☐

Signature to the training manager or EBT manager _____

(c) In order for the EBT manager to delegate their signature in accordance with point 4(c)(2) of Appendix 10 to another person to endorse the licence of the applicant, the following should apply:

(1) the person signing the licence should be nominated,

(2) the person signing the licence should hold or have held an instructor certificate,

(3) the approved procedure for delegation of signature should include procedures to prevent the person who received the delegation from signing the licence when the EBT programme applicable to the validity period has not been completed.

(d) The authority may customise the form above by requesting additional information or changing the order of the elements of the form.

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GM1 to Appendix 10 – Revalidation and renewal of type ratings, and revalidation and renewal of IRs when combined with the revalidation or renewal of type ratings – EBT practical assessment

REVALIDATION OF TYPE RATING – ADMINISTRATIVE PROCEDURES

(a) The operator may nominate several deputy EBT managers to ensure the availability of at least one examiner for each fleet, in the context of workload to manage the EBT programme, several locations of the training facilities, or bases, etc.

(b) For the first revalidation of type rating after the transition from mixed EBT, the examiner may use mixed EBT module(s) in addition to the other EBT module(s) as a means to revalidate the type rating.

(c) In accordance with the approved procedure in Appendix 10, 4. (c)(2), and as provided in AMC1 to Appendix 10 point (c), the EBT manager may nominate the EBT instructor who completed the EBT module as the person to whom the signature of the examiner is delegated. A stamp or electronic signature may exclusively be given from the EBT manager to the EBT instructor, in order to document the delegation in a transparent and secure manner. Following that process, EBT instructors on behalf of the EBT manager can endorse an applicant's licence.

(d) The EBT programme is included in the operations manual and, in accordance with ORO.FC.145 of Regulation (EU) No 965/2012, for CAT it is subject to prior approval including any changes, its syllabi and the use of individual FSTD.

GM2 to Appendix 10 – Revalidation and renewal of type ratings and revalidation and renewal of IRs when combined with the revalidation or renewal of type ratings – EBT practical assessment

EBT PRACTICAL ASSESSMENT — PROFICIENCY CHECK

EBT practical assessment (or Practical assessment) is defined in FCL.010. More information can be found in ICAO Doc 9868 'PANS-TRG'.

The demonstration of skills to revalidate or renew referred to in the definition of proficiency check in FCL.010 is equivalent to the EBT practical assessments conducted in the EBT programme and the final review of the examiner. In fact, one single EBT practical assessment demonstrates the necessary skills performed in legacy training; however, EBT goes one step further — to revalidate or renew, the pilot performs at least two demonstrations, corresponding to at least two EBT modules within the validity period of the type rating

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