

Appendix 1 to Terms of reference: Requirements regarding theoretical knowledge examinations for the issue of pilot licences

(a) *Responsibilities of the applicant*

- (1) Applicants shall take the entire set of examinations in one Member State.
- (2) Applicants shall only take the examination when recommended by the approved training organisation responsible for their training, once they have completed the appropriate elements of the training course of theoretical knowledge instruction to a satisfactory standard.

(b) *Pass standards*

- (1) A pass in an examination paper will be awarded to an applicant achieving at least 75% of the marks allocated to that paper. There is no penalty marking.
- (2) Except when otherwise determined in this Part, an applicant has successfully completed the required theoretical knowledge examination for the appropriate pilot licence or rating when he/she has passed all of the required subjects within a period of 18 months counted from the end of the calendar month when the applicant first attempted an examination.
- (3) If an applicant has failed to pass one of the examination papers within 4 attempts, or has failed to pass all papers within either six attempts or the period mentioned in paragraph (2), he/she shall re-take the complete set of examination papers.

Before re-taking the examinations, the applicant shall undertake further training at an approved training organisation. The extent and scope of the training needed shall be agreed between the training organisation and the competent authority, based on the needs of the applicant.

(c) *Validity period*

- (1) The successful completion of the theoretical knowledge examinations will be valid:
 - (i) for the issue of a leisure pilot licence, a private pilot licence, a sailplane pilot licence or a balloon pilot licence, for a period of 24 months;
 - (ii) for the issue of a commercial pilot licence or instrument rating, for a period of 36 months;
 - (iii) the periods in (i) and (ii) shall be counted from the day when the pilot successfully completes the theoretical knowledge examination, in accordance with (b)(2).
- (2) Provided that the applicant holds an instrument rating, the completion of the airline transport pilot licence theoretical knowledge examinations will remain valid for a period of 7 years from the last validity date of the instrument rating entered in the commercial pilot licence for the issuance of an airline transport pilot licence.

**Appendix 2 to Terms of reference: Theoretical knowledge examination subjects/sections
and length of examinations**

THEORETICAL KNOWLEDGE EXAMINATION SUBJECTS – DURATION AND MINIMUM NUMBER OF QUESTIONS

	ATPL (A) (14 exams)		CPL (A) (13 exams)		ATPL (H)/IR (14 exams)		ATPL (H) (13 exams)		CPL (H) (13 exams)		IR (A) & (H) (7 exams)	
1	Duration	Questions	Duration	Questions	Duration	Questions	Duration	Questions	Duration	Questions	Duration	Questions
2 Subject Reference												
010	1:00	44	0:45	33	1:00	44	0:45	33	0:45	33	0:45	33
021	2:00	80	1:30	60	2:00	80	2:00	80	1:30	60	xx	xx
022	1:30	60	1:00	40	1:30	60	1:30	60	1:00	40	0:30	20
031	1:00	25	1:00	25	1:00	25	1:00	25	1:00	25	xx	xx
032	1:00	35	0:45	25	xx	xx	xx	xx	xx	xx	xx	xx
033	2:00	43	1:30	33	2:00	43	1:30	33	1:30	33	1:30	33
034	xx	xx	xx	xx	1:00	35	1:00	35	0:45	20	xx	xx
040	1:00	48	0:45	36	1:00	48	1:00	48	0:45	36	0:45	36
050	2:00	84	1:30	63	2:00	84	2:00	84	1:30	63	1:30	63
061	2:00	60	1:30	45	2:00	60	2:00	60	1:30	45	xx	xx
062	1:30	66	0:30	22	1:30	66	1:00	44	0:30	22	1:00	44
071	1:15	45	0:45	30	1:00	38	1:00	38	0:45	30	xx	xx
081	1:00	44	0:45	33	xx	xx	xx	xx	xx	xx	xx	Xx
082	xx	xx	xx	xx	1:00	44	1:00	44	1:00	44	xx	xx
091	0:30	24	0:30	24	0:30	24	0:30	24	0:30	24	xx	xx
092	0:30	24	xx	xx	0:30	24	xx	xx	xx	xx	0:30	24

Totals	18:15	682	13:15	492	18:00	675	16:15	608	13:30	505	7:00	251

Attachment 2
DISTRIBUTION OF EXAMINATION QUESTIONS

Subject : 010 - AIR LAW
Theoretical knowledge examination
Exam length, total questions and distribution of questions

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR (A) & (H)
Time allowed	1:00	0:45	1:00	0:45	0:45	0:45
Distribution of questions with regard to the topics of the syllabus						
010 01	3	2	3	3	2	2
02	2	2	2	2	2	2
03	1	1	1	1	1	XX
04	2	2	2	2	2	1
05	8	8	8	8	8	8
06	7	4	7	3	4	7
07	5	3	5	3	3	5
08	2	2	2	2	2	2
09	6	4	6	4	4	6
10	2	1	2	1	1	XX
11	2	2	2	2	2	XX
12	2	1	2	1	1	XX
13	2	1	2	1	1	XX
Total questions	44	33	44	33	33	33

Subject : 021 - AIRCRAFT GENERAL KNOWLEDGE - AIRFRAME/SYSTEMS/POWER PLANT
Theoretical knowledge examination
Exam length, total questions and distribution of questions

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	2:00	1:30	2:00	2:00	1:30	XX
Distribution of questions with regard to the topics of the syllabus						
021 01	04	02	04	04	02	XX
02	04	04	04	04	02	XX
03	005	02	04	04	03	XX
04	05	06	04	04	02	XX
05	07	04	06	06	03	XX
06	05	04	04	04	02	XX
07	04	04	02	02	02	XX
08	06	04	04	04	04	XX
09	06	06	06	06	04	XX
10	06	14	06	06	08	XX
11	20	06	20	20	13	XX
12	04	02	02	02	02	XX
13	04	02	XX	XX	XX	XX
14	XX	XX	01	01	01	XX
15	XX	XX	04	04	03	XX
16	XX	XX	06	06	05	XX
17	XX	XX	03	03	04	XX
Total questions	80	60	80	80	60	XX

Subject : 022 - AIRCRAFT GENERAL KNOWLEDGE - INSTRUMENTATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	1:30	1:00	1:30	1:30	1:00	0:30
Distribution of questions with regard to the topics of the syllabus						
022 01	08	08	08	08	08	XX
02	08	06	08	08	06	06
03	04	04	04	04	04	04
04	04	05	06	06	05	04
05	05	XX	03	03	XX	XX
06	08	06	XX	XX	XX	XX
07	XX	XX	14	14	08	XX
08	03	02	XX	XX	XX	XX
09	02	XX	XX	XX	XX	XX
10	02	XX	XX	XX	XX	XX
11	04	XX	04	04	XX	XX
12	06	04	06	06	04	03
13	04	04	05	05	04	03
14	01	XX	01	01	XX	XX
15	01	01	01	01	01	XX
Total questions	60	40	60	60	40	20

Subject : 031 - FLIGHT PERFORMANCE AND PLANNING - MASS AND BALANCE						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	1:00	1:00	1:00	1:00	1:00	XX
Distribution of questions with regard to the topics of the syllabus						
031 01	03	03	03	03	03	XX
02	05	05	05	05	05	XX
03	05	05	05	05	05	XX
04	05	05	05	05	05	XX
05	05	05	05	05	05	XX
06	02	02	02	02	02	XX
Total questions	25	25	25	25	25	XX

Subject : 032 - FLIGHT PERFORMANCE AND PLANNING - PERFORMANCE (AEROPLANES)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	1:00	0:45	XX	XX	XX	XX
Distribution of questions with regard to the topics of the syllabus						
032 01	05	05	XX	XX	XX	XX
02	10	10	XX	XX	XX	XX
03	10	10	XX	XX	XX	XX
04	10	XX	XX	XX	XX	XX
Total questions	35	25	XX	XX	XX	XX

Subject : 033 - FLIGHT PERFORMANCE AND PLANNING - FLIGHT PLANNING AND MONITORING						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	2:00	1:30	2:00	1:30	1:30	1:30
Distribution of questions with regard to the topics of the syllabus						
033 01	05	05	05	05	05	XX
02	10	XX	10	XX	XX	10
03	10	10	10	10	10	05
04	08	08	08	08	08	08
05	05	05	05	05	05	05
06	05	05	05	05	05	05
Total questions	43	33	43	33	33	33

Subject : 034 - FLIGHT PERFORMANCE AND PLANNING - PERFORMANCE (HELICOPTERS)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	XX	XX	1:00	1:00	0:45	XX
Distribution of questions with regard to the topics of the syllabus						
034 01	XX	XX	15	15	15	XX
02	XX	XX	05	05	05	XX
03	XX	XX	05	05	XX	XX
04	XX	XX	10	10	XX	XX
Total questions	XX	XX	35	35	20	XX

Subject : 040 HUMAN PERFORMANCE						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	1:00	0:45	1:00	1:00	0:45	0:45
Distribution of questions with regard to the topics of the syllabus						
040 01	02	01	02	02	01	01
02	33	26	33	33	26	26
03	13	09	13	13	09	09
Total questions	48	36	48	48	36	36

Subject : 050 METEOROLOGY						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	2:00	1:30	2:00	2:00	1:30	1:30
Distribution of questions with regard to the topics of the syllabus						
050 01	11	09	11	11	09	09
02	11	06	11	11	06	06
03	04	04	04	04	04	04
04	07	06	07	07	06	06
05	03	03	03	03	03	03
06	07	07	07	07	07	07
07	06	02	06	06	02	02
08	08	03	08	08	03	03
09	11	09	11	11	09	09
10	16	14	16	16	14	14

Total questions	84	63	84	84	63	63
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Subject : 061 - GENERAL NAVIGATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR (A) & (H)
Time allowed	2:00	1:30	2:00	2:00	1:30	XX
Distribution of questions with regard to the topics of the syllabus						
061 01	12	07	12	12	07	XX
02	04	04	04	04	04	XX
03	14	12	14	14	12	XX
04	16	11	16	16	11	XX
05	14	11	14	14	11	XX
Total :	60	45	60	60	45	XX

Subject : 062 - RADIO NAVIGATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR (A) & (H)
Time allowed	1:30	0:30	1:30	1:00	0:30	1:00
Distribution of questions with regard to the topics of the syllabus						
062 01	07	04	07	05	04	02
02	21	12	21	15	12	23
03	12	02	02	08	02	05
04	XX	XX	XX	XX	XX	XX
05	15	XX	15	10	XX	10
06	11	04	11	06	04	04

Total questions	66	22	66	44	22	44
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Subject : 070 OPERATIONAL PROCEDURES						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	1:15	0:45	1:00	1:00	0:45	XX
Distribution of questions with regard to the topics of the syllabus						
071 01	25	18	18	18	14	XX
02	20	12	14	14	12	XX
03	XX	XX	06	06	04	XX
Total questions	45	30	38	38	30	XX

Subject : 081 PRINCIPLES OF FLIGHT (AEROPLANES)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL (A)	CPL (A)	ATPL (H)/IR	ATPL (H)	CPL (H)	IR (A) & (H)
Time allowed	1:00	0:45	XX	XX	XX	XX
Distribution of questions with regard to the topics of the syllabus						
081 01	17	14	XX	XX	XX	XX
02	06	XX	XX	XX	XX	XX
03	XX	XX	XX	XX	XX	XX
04	06	06	XX	XX	XX	XX
05	04	03	XX	XX	XX	XX
06	03	03	XX	XX	XX	XX
07	04	03	XX	XX	XX	XX
08	04	04	XX	XX	XX	XX
Total questions	44	33	XX	XX	XX	XX

Subject : 082 PRINCIPLES OF FLIGHT (HELICOPTERS)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed	XX	XX	1:00	1:00	1:00	XX
Distribution of questions with regard to the topics of the syllabus						
082 01	XX	XX	05	05	05	XX
02	XX	XX	03	03	03	XX
03	XX	XX	01	01	01	XX
04	XX	XX	12	12	12	XX
05	XX	XX	10	10	10	XX
06	XX	XX	05	05	05	XX
07	XX	XX	05	05	05	XX
08	XX	XX	03	03	03	XX
Total questions	XX	XX	44	44	44	XX

Subject : 091 VFR COMMUNICATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A)
Time allowed	00:30	00:30	00:30	00:30	00:30	XX

Distribution of questions with regard to the topics of the syllabus						
091 01	05	05	05	05	05	XX
02	11	11	11	11	11	XX
03	02	02	02	02	02	XX

04	02	02	02	02	02	XX
05	02	02	02	02	02	XX
06	02	02	02	02	02	XX
Total :	24	24	24	24	24	XX

Subject : 092 IFR COMMUNICATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A)
Time allowed	00:30	XX	00:30	XX	XX	00:30

092 01	05	XX	05	XX	XX	05
02	11	XX	11	XX	XX	11
03	02	XX	02	XX	XX	02
04	02	XX	02	XX	XX	02
05	02	XX	02	XX	XX	02
06	02	XX	02	XX	XX	02
07	XX	XX	XX	XX	XX	XX
Total :	24	XX	24	XX	XX	24

Appendix 3 to the Terms of reference of this call for tender:

Requirements for Part 66 examinations

A/ First part:

(Appendix I to Part 66)

Basic knowledge requirements

1. KNOWLEDGE LEVELS – CATEGORY A, B1, B2, B3 AND C AIRCRAFT MAINTENANCE LICENCE

Basic knowledge for categories A, B1, and B2 and B3 are indicated by the allocation of knowledge levels indicators (1, 2 or 3) against each applicable subject. Category C applicants must meet either the category B1 or the category B2 basic knowledge levels.

The knowledge level indicators are defined as follows:

LEVEL 1

A familiarisation with the principal elements of the subject.

Objectives: The applicant should be familiar with the basic elements of the subject.

The applicant should be able to give a simple description of the whole subject, using common words and examples.

The applicant should be able to use typical terms.

LEVEL 2

A general knowledge of the theoretical and practical aspects of the subject.

An ability to apply that knowledge.

Objectives: The applicant should be able to understand the theoretical fundamentals of the subject.

The applicant should be able to give a general description of the subject using, as appropriate, typical examples.

The applicant should be able to use mathematical formulae in conjunction with physical laws describing the subject.

The applicant should be able to read and understand sketches, drawings and schematics describing the subject.

The applicant should be able to apply his knowledge in a practical manner using detailed procedures.

LEVEL 3

A detailed knowledge of the theoretical and practical aspects of the subject.

A capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner.

Objectives: The applicant should know the theory of the subject and interrelationships with other subjects.

The applicant should be able to give a detailed description of the subject using theoretical fundamentals and specific examples.

The applicant should understand and be able to use mathematical formulae related to the subject.

The applicant should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.

The applicant should be able to apply his knowledge in a practical manner using manufacturer's instructions.

The applicant should be able to interpret results from various sources and measurements and apply corrective action where appropriate.

2. MODULARISATION

Qualification on basic subjects for each Part-66 aircraft maintenance licence category or subcategory should be in accordance with the following matrix. Applicable subjects are indicated by an 'X':

Subject module	A or B1 aeroplane with:		A or B1 helicopter with:		B2	B3
	Turbine engine(s)	Piston engine(s)	Turbine engine(s)	Piston engine(s)	Avionics	Sailplanes, powered sailplanes and non pressurized piston engine aeroplanes of 2T MTOM and less
1	X	X	X	X	X	X
2	X	X	X	X	X	X
3	X	X	X	X	X	X
4	X	X	X	X	X	X
5	X	X	X	X	X	X
6	X	X	X	X	X	X
7	X	X	X	X	X	X
8	X	X	X	X	X	X
9	X	X	X	X	X	X
10	X	X	X	X	X	X
11	X	X				X
12			X	X		
13					X	
14					X	
15	X		X			
16		X		X		X
17	X	X				X

MODULE 1. MATHEMATICS

	LEVEL			
	A	B1	B2	B3
1.1 Arithmetic	1	2	2	2
Arithmetical terms and signs, methods of multiplication and division, fractions and decimals, factors and multiples, weights, measures and conversion factors, ratio and proportion, averages and percentages, areas and volumes, squares, cubes, square and cube roots.				

	LEVEL			
	A	B1	B2	B3
1.2 Algebra				
(a)	1	2	2	2
Evaluating simple algebraic expressions, addition, subtraction, multiplication and division, use of brackets, simple algebraic fractions;				
(b)	-	1	1	1
Linear equations and their solutions;				
Indices and powers, negative and fractional indices;				
Binary and other applicable numbering systems;				
Simultaneous equations and second degree equations with one unknown;				
Logarithms;				
1.3 Geometry				
(a)	-	1	1	1
Simple geometrical constructions;				
(b)	2	2	2	2
Graphical representation; nature and uses of graphs, graphs of equations/functions;				
(c)	-	2	2	2
Simple trigonometry; trigonometrical relationships, use of tables and rectangular and polar coordinates.				

MODULE 2. PHYSICS

	LEVEL			
	A	B1	B2	B3
2.1 Matter	1	1	1	1
Nature of matter: the chemical elements, structure of atoms, molecules;				
Chemical compounds.				
States: solid, liquid and gaseous;				
Changes between states.				
2.2 Mechanics				
2.2.1 Statics	1	2	1	1
Forces, moments and couples, representation as vectors;				
Centre of gravity;				
Elements of theory of stress, strain and elasticity: tension, compression, shear and torsion;				
Nature and properties of solid, fluid and gas;				
Pressure and buoyancy in liquids (barometers).				

	LEVEL			
	A	B1	B2	B3
2.2.2 Kinetics Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/ centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.	1	2	1	1
2.2.3 Dynamics (a) Mass Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; (b) Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).	1	2	1	1
2.2.4 Fluid dynamics (a) Specific gravity and density; (b) Viscosity, fluid resistance, effects of streamlining; Effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.	2	2	2	2
2.3 Thermodynamics (a) Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. (b) Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps;	1	2	1	1

	LEVEL			
	A	B1	B2	B3
Latent heats of fusion and evaporation, thermal energy, heat of combustion.				
2.4 Optics (Light) Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.	-	2	2	-
2.5 Wave Motion and Sound Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler effect.	-	2	2	-

MODULE 3. ELECTRICAL FUNDAMENTALS

	LEVEL			
	A	B1	B2	B3
3.1 Electron Theory Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.	1	1	1	1
3.2 Static Electricity and Conduction Static electricity and distribution of electrostatic charges; Electrostatic laws of attraction and repulsion; Units of charge, Coulomb's Law; Conduction of electricity in solids, liquids, gases and a vacuum.	1	2	2	1
3.3 Electrical Terminology The following terms, their units and factors affecting them: potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow.	1	2	2	1
3.4 Generation of Electricity Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.	1	1	1	1

	LEVEL			
	A	B1	B2	B3
3.5 DC Sources of Electricity Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.	1	2	2	1
3.6 DC Circuits Ohms Law, Kirchoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply.	-	2	2	1
3.7 Resistance/Resistor (a) Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge.	-	2	2	1
(b) Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge;	-	1	1	-
3.8 Power Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.	-	2	2	1
3.9 Capacitance/Capacitor	-	2	2	1

	LEVEL			
	A	B1	B2	B3
Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric; Constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.				
3.10 Magnetism				
(a)	-	2	2	1
Theory of magnetism; Properties of a magnet; Action of a magnet suspended in the Earth's magnetic field; Magnetisation and demagnetisation; Magnetic shielding; Various types of magnetic material; Electromagnets construction and principles of operation; Hand clasp rules to determine: magnetic field around current carrying conductor.				
(b)	-	2	2	1
Magnetomotive force, field strength, magnetic flux density, permeability, hysteresis loop, retentivity, coercive force reluctance, saturation point, eddy currents; Precautions for care and storage of magnets.				
3.11 Inductance/Inductor	-	2	2	1
Faraday's Law; Action of inducing a voltage in a conductor moving in a magnetic field; Induction principles; Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductor turns; Mutual induction; The effect the rate of change of primary current and mutual inductance has on induced voltage; Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other; Lenz's Law and polarity determining rules; Back emf, self induction; Saturation point; Principle uses of inductors.				
3.12 DC Motor/Generator Theory	-	2	2	1

	LEVEL			
	A	B1	B2	B3
Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.				
3.13 AC Theory	1	2	2	1
Sinusoidal waveform: phase, period, frequency, cycle; Instantaneous, average, root mean square, peak, peak to peak current values and calculations of these values, in relation to voltage, current and power; Triangular/Square waves; Single/3 phase principles.				
3.14 Resistive (R), Capacitive (C) and Inductive (L) Circuits	-	2	2	1
Phase relationship of voltage and current in L, C and R circuits, parallel, series and series parallel; Power dissipation in L, C and R circuits; Impedance, phase angle, power factor and current calculations; True power, apparent power and reactive power calculations.				
3.15 Transformers	-	2	2	1
Transformer construction principles and operation; Transformer losses and methods for overcoming them; Transformer action under load and no-load conditions; Power transfer, efficiency, polarity markings; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.				
3.16 Filters	-	1	1	-
Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.				
3.17 AC Generators	-	2	2	1
Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators.				

	LEVEL			
	A	B1	B2	B3
3.18 AC Motors Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.	-	2	2	1

MODULE 4. ELECTRONIC FUNDAMENTALS

	LEVEL			
	A	B1	B2	B3
4.1 Semiconductors 4.1.1 Diodes (a) Diode symbols; Diode characteristics and properties; Diodes in series and parallel; Main characteristics and use of silicon controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes; Functional testing of diodes.	-	2	2	1
(b) Materials, electron configuration, electrical properties; P and N type materials: effects of impurities on conduction, majority and minority characters; PN junction in a semiconductor, development of a potential across a PN junction in unbiased, forward biased and reverse biased conditions; Diode parameters: peak inverse voltage, maximum forward current, temperature, frequency, leakage current, power dissipation; Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers; Detailed operation and characteristics of the following devices: silicon controlled rectifier (thyristor), light emitting diode, Schottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode.	-	-	2	-
4.1.2 Transistors (a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.	-	1	2	1
(b)	-	-	2	-

	LEVEL			
	A	B1	B2	B3
Construction and operation of PNP and NPN transistors; Base, collector and emitter configurations; Testing of transistors; Basic appreciation of other transistor types and their uses; Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilisation; Multistage circuit principles: cascades, push-pull, oscillators, multivibrators, flip-flop circuits. 4.1.3 Integrated Circuits (a) Description and operation of logic circuits and linear circuits/operational amplifiers. (b) Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback. 4.2 Printed Circuit Boards Description and use of printed circuit boards. 4.3 Servomechanisms (a) Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers; Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, transformers, inductance and capacitance transmitters. (b) Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, deadband; Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, synchronous transmitters; Servomechanism defects, reversal of synchro leads, hunting.				
	-	1	-	1
	-	-	2	-
	-	1	2	-
	-	1	-	1
	-	-	2	-

MODULE 5. DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS

	LEVEL				
	A	B1-1 B1-3	B1-2 B1-4	B2	B3
5.1 Electronic Instrument Systems Typical systems arrangements and cockpit layout of electronic instrument systems	1	2	2	3	1
5.2 Numbering Systems Numbering systems: binary, octal and hexadecimal; Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.	-	1	-	2	-
5.3 Data Conversion Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types.	-	1	-	2	-
5.4 Data Buses Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.	-	2	-	2	-
5.5 Logic Circuits (a) Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams.	-	2	-	2	-
(b) Interpretation of logic diagrams.	-	-	-	2	-
5.6 Basic Computer Structure (a) Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memory devices such as RAM, ROM, PROM); Computer technology (as applied in aircraft systems).	1	2	-	-	-
(b) Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multiaddress instruction words; Memory associated terms; Operation of typical memory devices; Operation, advantages and disadvantages of the various data storage systems.	-	-	-	2	-

	LEVEL				
	A	B1-1 B1-3	B1-2 B1-4	B2	B3
5.7 Microprocessors Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.	-	-	-	2	-
5.8 Integrated Circuits Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.	-	-	-	2	-
5.9 Multiplexing Operation, application and identification in logic diagrams of multiplexers and demultiplexers.	-	-	-	2	-
5.10 Fibre Optics Advantages and disadvantages of fibre optic data transmission over electrical wire propagation; Fibre optic data bus; Fibre optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fibre optics in aircraft systems.	-	1	1	2	-
5.11 Electronic Displays Principles of operation of common types of displays used in modern aircraft, including Cathode Ray Tubes, Light Emitting Diodes and Liquid Crystal Display.	-	2	1	2	1
5.12 Electrostatic Sensitive Devices Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.	1	2	2	2	1
5.13 Software Management Control Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes.	-	2	1	2	1
5.14 Electromagnetic Environment Influence of the following phenomena on maintenance practices for electronic system: EMC-Electromagnetic Compatibility EMI-Electromagnetic Interference HIRF-High Intensity Radiated Field Lightning/lightning protection	-	2	2	2	1

	LEVEL				
	A	B1-1 B1-3	B1-2 B1-4	B2	B3
5.15 Typical Electronic/Digital Aircraft Systems General arrangement of typical electronic/digital aircraft systems and associated BITE (Built In Test Equipment) testing such as: ACARS-ARINC Communication and Addressing and Reporting System ECAM-Electronic Centralised Aircraft Monitoring EFIS-Electronic Flight Instrument System EICAS-Engine Indication and Crew Alerting System FBW-Fly by Wire FMS-Flight Management System GPS-Global Positioning System IRS-Inertial Reference System TCAS-Traffic Alert Collision Avoidance System	-	2	2	2	1

MODULE 6. MATERIALS AND HARDWARE

	LEVEL			
	A	B1	B2	B3
6.1 Aircraft Materials — Ferrous (a) Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels.	1	2	1	2
(b) Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.	-	1	1	1
6.2 Aircraft Materials — Non-Ferrous (a) Characteristics, properties and identification of common non-ferrous materials used in aircraft; Heat treatment and application of non-ferrous materials;	1	2	1	2
(b) Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.	-	1	1	1
6.3 Aircraft Materials — Composite and Non-Metallic <i>6.3.1 Composite and non-metallic other than wood and fabric</i> (a)	1	2	2	2

	LEVEL			
	A	B1	B2	B3
Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents.				
(b)	1	2	-	2
The detection of defects/deterioration in composite and non-metallic material. Repair of composite and non-metallic material.				
<i>6.3.2 Wooden structures</i>	1	2	-	2
Construction methods of wooden airframe structures; Characteristics, properties and types of wood and glue used in aeroplanes; Preservation and maintenance of wooden structure; Types of defects in wood material and wooden structures; The detection of defects in wooden structure; Repair of wooden structure.				
<i>6.3.3 Fabric covering</i>	1	2	-	2
Characteristics, properties and types of fabrics used in aeroplanes; Inspections methods for fabric; Types of defects in fabric; Repair of fabric covering.				
6.4 Corrosion				
(a)	1	1	1	1
Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;				
(b)	2	3	2	2
Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.				
6.5 Fasteners				
<i>6.5.1 Screw threads</i>	2	2	2	2
Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; Measuring screw threads.				
<i>6.5.2 Bolts, studs and screws</i>	2	2	2	2
Bolt types: specification, identification and marking of aircraft bolts, international standards; Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications;				

	LEVEL			
	A	B1	B2	B3
Studs: types and uses, insertion and removal; Self tapping screws, dowels. <i>6.5.3 Locking devices</i> Tab and spring washers, locking plates, split pins, pal-nuts, wire locking, quick release fasteners, keys, circlips, cotter pins. <i>6.5.4 Aircraft rivets</i> Types of solid and blind rivets: specifications and identification, heat treatment. 6.6 Pipes and Unions (a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft; (b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes. 6.7 Springs Types of springs, materials, characteristics and applications. 6.8 Bearings Purpose of bearings, loads, material, construction; Types of bearings and their application. 6.9 Transmissions Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets. 6.10 Control Cables Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems. 6.11 Electrical Cables and Connectors Cable types, construction and characteristics; High tension and co-axial cables; Crimping; Connector types, pins, plugs, sockets, insulators, current and voltage rating, coupling, identification codes.				
	2	2	2	2
	1	2	1	2
	2	2	2	2
	2	2	1	2
	-	2	1	1
	1	2	2	1
	1	2	2	1
	1	2	1	2
	1	2	2	2

MODULE 7. MAINTENANCE PRACTICES

	LEVEL			
	A	B1	B2	B3
7.1 Safety Precautions-Aircraft and Workshop Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals. Also, instruction in the remedial action to be taken in the event of a fire or another accident with one or more of these hazards including knowledge on extinguishing agents.	3	3	3	3
7.2 Workshop Practices Care of tools, control of tools, use of workshop materials; Dimensions, allowances and tolerances, standards of workmanship; Calibration of tools and equipment, calibration standards.	3	3	3	3
7.3 Tools Common hand tool types; Common power tool types; Operation and use of precision measuring tools; Lubrication equipment and methods. Operation, function and use of electrical general test equipment;	3	3	3	3
7.4 Avionic General Test Equipment Operation, function and use of avionic general test equipment.	-	2	3	-
7.5 Engineering Drawings, Diagrams and Standards Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerised presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including ISO, AN, MS, NAS and MIL; Wiring diagrams and schematic diagrams.	1	2	2	2
7.6 Fits and Clearances Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.	1	2	1	2
7.7 Electrical Cables and Connectors	1	2	2	2

	LEVEL			
	A	B1	B2	B3
Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.				
7.8 Riveting	1	2	-	2
Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.				
7.9 Pipes and Hoses	1	2	-	2
Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.				
7.10 Springs	1	2	-	1
Inspection and testing of springs.				
7.11 Bearings	1	2	-	2
Testing, cleaning and inspection of bearings; Lubrication requirements of bearings; Defects in bearings and their causes.				
7.12 Transmissions	1	2	-	2
Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push-pull rod systems.				
7.13 Control Cables	1	2	-	2
Swaging of end fittings; Inspection and testing of control cables; Bowden cables; aircraft flexible control systems.				
7.14 Material handling				
<i>7.14.1 Sheet Metal</i>	-	2	-	2
Marking out and calculation of bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.				
<i>7.14.2 Composite and non-metallic</i>	-	2	-	2

	LEVEL			
	A	B1	B2	B3
Bonding practices; Environmental conditions; Inspection methods.				
7.15 Welding, Brazing, Soldering and Bonding				
(a)	-	2	2	2
Soldering methods; inspection of soldered joints.				
(b)	-	2	-	2
Welding and brazing methods; Inspection of welded and brazed joints; Bonding methods and inspection of bonded joints.				
7.16 Aircraft Weight and Balance				
(a)	-	2	2	2
Centre of Gravity/Balance limits calculation: use of relevant documents;				
(b)	-	2	-	2
Preparation of aircraft for weighing; Aircraft weighing				
(c)	-	-	-	1
Sailplanes water ballast (only required for B3)				
7.17 Aircraft Handling and Storage	2	2	2	2
Aircraft taxiing/towing and associated safety precautions; Aircraft jacking, chocking, securing and associated safety precautions; Aircraft storage methods; Refuelling/defuelling procedures; De-icing/anti-icing procedures; Electrical, hydraulic and pneumatic ground supplies. Effects of environmental conditions on aircraft handling and operation.				
7.18 Disassembly, Inspection, Repair and Assembly Techniques				
(a)	2	3	2	3
Types of defects and visual inspection techniques. Corrosion removal, assessment and reprotection.				
(b)	-	2	-	2
General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes;				

	LEVEL			
	A	B1	B2	B3
(c) Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods.	-	2	1	2
(d) Disassembly and re-assembly techniques.	2	2	2	2
(e) Trouble shooting techniques	-	2	2	2
7.19 Abnormal Events				
(a) Inspections following lightning strikes and HIRF penetration.	2	2	2	2
(b) Inspections following abnormal events such as heavy landings and flight through turbulence.	2	2	-	2
7.20 Maintenance Procedures	1	2	2	2
Maintenance planning;				
Modification procedures;				
Stores procedures;				
Certification/release procedures;				
Interface with aircraft operation;				
Maintenance Inspection/Quality Control/Quality Assurance;				
Additional maintenance procedures.				
Control of life limited components				

MODULE 8. BASIC AERODYNAMICS

	LEVEL			
	A	B1	B2	B3
8.1 Physics of the Atmosphere	1	2	2	1
International Standard Atmosphere (ISA), application to aerodynamics.				
8.2 Aerodynamics	1	2	2	1

	LEVEL			
	A	B1	B2	B3
Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.				
8.3 Theory of Flight	1	2	2	1
Relationship between lift, weight, thrust and drag; Glide ratio; Steady state flights, performance; Theory of the turn; Influence of load factor: stall, flight envelope and structural limitations; Lift augmentation.				
8.4 Flight Stability and Dynamics	1	2	2	1
Longitudinal, lateral and directional stability (active and passive).				

MODULE 9. HUMAN FACTORS

	LEVEL			
	A	B1	B2	B3
9.1 General	1	2	2	2
The need to take human factors into account; Incidents attributable to human factors/human error; 'Murphy's' law.				
9.2 Human Performance and Limitations	1	2	2	2
Vision; Hearing; Information processing; Attention and perception; Memory; Claustrophobia and physical access.				
9.3 Social Psychology	1	1	1	1

	LEVEL			
	A	B1	B2	B3
Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.				
9.4 Factors Affecting Performance	2	2	2	2
Fitness/health; Stress: domestic and work related; Time pressure and deadlines; Workload: overload and underload; Sleep and fatigue, shiftwork; Alcohol, medication, drug abuse.				
9.5 Physical Environment	1	1	1	1
Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.				
9.6 Tasks	1	1	1	1
Physical work; Repetitive tasks; Visual inspection; Complex systems.				
9.7 Communication	2	2	2	2
Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.				
9.8 Human Error	1	2	2	2
Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e accidents); Avoiding and managing errors.				
9.9 Hazards in the Workplace	1	2	2	2
Recognising and avoiding hazards;				

	LEVEL			
	A	B1	B2	B3
Dealing with emergencies.				

MODULE 10. AVIATION LEGISLATION

	LEVEL			
	A	B1	B2	B3
10.1 Regulatory Framework Role of International Civil Aviation Organisation; Role of EASA; Role of the Member States; Relationship between Part-145, Part-66, Part-147 and Part-M; Relationship with other Aviation Authorities.	1	1	1	1
10.2 Part-66 – Certifying Staff – Maintenance Detailed understanding of Part-66.	2	2	2	2
10.3 Part-145 - Part-M Subpart F – Approved Maintenance Organisations Detailed understanding of Part-145.	2	2	2	2
10.4 JAR-OPS – Commercial Air Transportation Air Operators Certificates; Operators Responsibilities; Documents to be Carried; Aircraft Placarding (Markings);	1	1	1	-
10.5 Aircraft Certification <i>(a) General</i> Certification rules: such as EACS 23/25/27/29; Type Certification; Supplemental Type Certification; Part-21 Design/Production Organisation Approvals.	-	1	1	1
<i>(b) Documents</i> Certificate of Airworthiness; Certificate of Registration; Noise Certificate; Weight Schedule; Radio Station Licence and Approval.	-	2	2	2
10.6 Part-M Detailed understanding of Part-M.	2	2	2	2

	LEVEL			
	A	B1	B2	B3
10.7 Applicable National and International Requirements for (if not superseded by EU requirements) (a) Maintenance Programmes, Maintenance checks and inspections; Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists; Airworthiness Directives; Service Bulletins, manufacturers service information; Modifications and repairs; Maintenance documentation: maintenance manuals, structural repair manual, illustrated parts catalogue, etc.; (b) Continuing airworthiness; Test flights; ETOPS, maintenance and dispatch requirements; All Weather Operations, Category 2/3 operations and minimum equipment requirements.	1	2	2	2
	-	1	1	1

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

	LEVEL		
	A	B1.1	B2
11.1 Theory of Flight 11.1.1 Aeroplane Aerodynamics and Flight Controls Operation and effect of: – roll control: ailerons and spoilers; – pitch control: elevators, stabilators, variable incidence stabilisers and canards; – yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flaperons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels; 11.1.2 High Speed Flight	1	2	-
	1	2	-

	LEVEL		
	A	B1.1	B2
Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.			
11.2 Airframe Structures – General Concepts (a) Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision. Aircraft bonding	2	2	-
(b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning. Airframe symmetry: methods of alignment and symmetry checks.	1	2	-
11.3 Airframe Structures – Aeroplanes <i>11.3.1 Fuselage (ATA 52/53/56)</i> Construction and pressurisation sealing; Wing, stabiliser, pylon and undercarriage attachments; Seat installation and cargo loading system; Doors and emergency exits: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.	1	2	-
<i>11.3.2 Wings (ATA 57)</i> Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.	1	2	-
<i>11.3.3 Stabilisers (ATA 55)</i> Construction; Control surface attachment.	1	2	-
<i>11.3.4 Flight Control Surfaces (ATA 55/57)</i>	1	2	-

	LEVEL		
	A	B1.1	B2
Construction and attachment; Balancing — mass and aerodynamic.			
<i>11.3.5 Nacelles/Pylons (ATA 54)</i>	1	2	-
Construction; Firewalls; Engine mounts.			
11.4 Air Conditioning and Cabin Pressurisation (ATA 21)			
<i>11.4.1 Air supply</i>	1	2	-
Sources of air supply including engine bleed, APU and ground cart;			
<i>11.4.2 Air Conditioning</i>	1	3	-
Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.			
<i>11.4.3 Pressurisation</i>	1	3	-
Pressurisation systems; Control and indication including control and safety valves; Cabin pressure controllers			
<i>11.4.4 Safety and warning devices</i>	1	3	-
Protection and warning devices.			
11.5 Instruments/Avionic Systems			
<i>11.5.1 Instrument Systems (ATA 31)</i>	1	2	-
Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Other aircraft system indication.			
<i>11.5.2 Avionic Systems</i>	1	1	-
Fundamentals of system lay-outs and operation of; Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).			
11.6 Electrical Power (ATA 24)	1	3	-

	LEVEL		
	A	B1.1	B2
Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection. External/Ground power;			
11.7 Equipment and Furnishings (ATA 25)			
(a)	2	2	-
Emergency equipment requirements; Seats, harnesses and belts.			
(b)	1	1	-
Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.			
11.8 Fire Protection (ATA 26)			
(a)	1	3	-
Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.			
(b)	1	1	-
Portable fire extinguisher			
11.9 Flight Controls (ATA 27)	1	3	-
Primary controls: aileron, elevator, rudder, spoiler; Trim control; Active load control; High lift devices; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic, electrical, fly-by-wire; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks systems; Balancing and rigging; Stall protection/warning system.			
11.10 Fuel Systems (ATA 28)	1	3	-

	LEVEL		
	A	B1.1	B2
System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling; Longitudinal balance fuel systems.			
11.11 Hydraulic Power (ATA 29)	1	3	-
System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.			
11.12 Ice and Rain Protection (ATA 30)	1	3	-
Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, hot air, pneumatic and chemical; Rain repellant; Probe and drain heating. Wiper systems			
11.13 Landing Gear (ATA 32)	2	3	-
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering.			
11.14 Lights (ATA 33)	2	3	-
External: navigation, anti-collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.			
11.15 Oxygen (ATA 35)	1	3	-
System lay-out: cockpit, cabin; Sources, storage, charging and distribution;			

	LEVEL		
	A	B1.1	B2
Supply regulation; Indications and warnings;			
11.16 Pneumatic/Vacuum (ATA 36) System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.	1	3	-
11.17 Water/Waste (ATA 38) Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.	2	3	-
11.18 On Board Maintenance Systems (ATA 45) Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).	1	2	-
11.19. Integrated Modular Avionics (ATA42) Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others: Bleed Management, Air Pressure Control, Air Ventilation and Control, Avionics and Cockpit Ventilation Control, Temperature Control, Air Traffic Communication, Avionics Communication Router, Electrical Load Management, Circuit Breaker Monitoring, Electrical System BITE, Fuel Management, Braking Control, Steering Control, Landing Gear Extension and Retraction, Tyre Pressure Indication, Oleo Pressure Indication, Brake Temperature Monitoring, etc.	1	2	-
11.20. Cabin Intercommunication Data Systems (ATA44) These systems provide an interface between cockpit/cabin crew and cabin systems. These systems support data exchange of the different related LRU's and they are typically operated via Flight Attendant Panels.	1	2	-
11.21. Cabin Network Service (ATA44) Typically consists on a server, typically interfacing with, among others, the following systems: Data/Radio Communication, In-Flight Entertainment System. The Cabin Network Service may host functions such as:	1	2	-
• Access to pre-departure/departure reports, • E-mail/intranet/internet access, • Passenger database,			

	LEVEL		
	A	B1.1	B2
11.22. Information Systems such as Air Traffic and Information Management Systems and Network Server Systems (ATA46)	1	2	-

MODULE 11B. PISTON AEROPLANE, SAILPLANE AND POWERED SAILPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

Note: The scope of this Module should reflect the technology of aeroplanes, sailplanes and powered sailplanes to the A2, B1.2 and B3 category.

	LEVEL			
	A	B1	B2	B3
11.1 Theory of Flight				
<i>11.1.1 Aeroplane Aerodynamics and Flight Controls</i>	1	2	-	1
Operation and effect of:				
— roll control: ailerons and spoilers;				
— pitch control: elevators, stabilators, variable incidence stabilisers and canards;				
— yaw control, rudder limiters;				
Control using elevons, ruddervators;				
High lift devices, slots, slats, flaps, flaperons;				
Drag inducing devices, spoilers, lift dumpers, speed brakes;				
Effects of wing fences, saw tooth leading edges;				
Boundary layer control using, vortex generators, stall wedges or leading edge devices;				
Operation and effect of trim tabs, balance and anti-balance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;				
<i>11.1.2 High Speed Flight — N/A</i>	-	-	-	-
11.2 Airframe Structures — General Concepts				
(a)	2	2	-	2
Airworthiness requirements for structural strength;				
Structural classification, primary, secondary and tertiary;				
Fail safe, safe life, damage tolerance concepts;				
Zonal and station identification systems;				
Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue;				
Drains and ventilation provisions;				
System installation provisions;				
Lightning strike protection provision;				
Aircraft bonding.				
(b)	1	2	-	2

	LEVEL			
	A	B1	B2	B3
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning; Airframe symmetry: methods of alignment and symmetry checks. 11.3 Airframe Structures – Aeroplanes <i>11.3.1 Fuselage (ATA 52/53/56)</i> Construction and pressurisation sealing; Wing, tail-plane pylon and undercarriage attachments; Seat installation; Doors and emergency exits: construction and operation; Window and windscreen attachment. <i>11.3.2 Wings (ATA 57)</i> Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments. <i>11.3.3 Stabilisers (ATA 55)</i> Construction; Control surface attachment. <i>11.3.4 Flight Control Surfaces (ATA 55/57)</i> Construction and attachment; Balancing — mass and aerodynamic. <i>11.3.5 Nacelles/Pylons (ATA 54)</i> (a) Nacelles/Pylons: — Construction; — Firewalls; — Engine mounts. 11.4 Air Conditioning and Cabin Pressurisation (ATA 21) (a) Pressurisation and air conditioning systems; Cabin pressure controllers, protection and warning devices. Heating systems				
	1	2	-	1
	1	2	-	1
	1	2	-	1
	1	2	-	1
	1	2	-	1
	1	3	-	-

	LEVEL			
	A	B1	B2	B3
(b)				
Heating systems	-	-	-	1
11.5 Instruments/Avionic Systems				
<i>11.5.1 Instrument Systems (ATA 31)</i>	1	2	-	1
Pitot static: altimeter, air speed indicator, vertical speed indicator;				
Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator;				
Compasses: direct reading, remote reading;				
Angle of attack indication, stall warning systems.				
Glass cockpit				
Other aircraft system indication.				
<i>11.5.2 Avionic Systems</i>	1	1	-	1
Fundamentals of system lay-outs and operation of:				
— Auto Flight (ATA 22);				
— Communications (ATA 23);				
— Navigation Systems (ATA 34).				
11.6 Electrical Power (ATA 24)	1	3	-	2
Batteries Installation and Operation;				
DC power generation;				
Voltage regulation;				
Power distribution;				
Circuit protection;				
Inverters, transformers.				
11.7 Equipment and Furnishings (ATA 25)				
(a)	2	2	-	2
Emergency equipment requirements;				
Seats, harnesses and belts.				
(b)	1	1	-	-
Cabin lay-out;				
Equipment lay-out;				
Cabin Furnishing Installation (level 2);				
Cabin entertainment equipment;				
Galley installation;				
Cargo handling and retention equipment;				
Airstairs.				
11.8 Fire Protection (ATA 26)				

	LEVEL			
	A	B1	B2	B3
(a) Fire extinguishing systems; Fire and smoke detection and warning systems; System tests.	1	3	-	1
(b) Portable fire extinguisher.	1	3	-	2
11.9 Flight Controls (ATA 27) Primary controls: aileron, elevator, rudder; Trim tabs; High lift devices; System operation: manual; Gust locks; Balancing and rigging; Stall warning system.	1	3	-	3
11.10 Fuel Systems (ATA 28) System lay-out; Fuel tanks; Supply systems; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling.	1	3	-	2
11.11 Hydraulic Power (ATA 29) System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical; Pressure Control; Power distribution; Indication and warning systems.	1	3	-	2
11.12 Ice and Rain Protection (ATA 30) Ice formation, classification and detection; De-icing systems: electrical, hot air, pneumatic and chemical; Probe and drain heating; Wiper systems.	1	3	-	1
11.13 Landing Gear (ATA 32)	2	3	-	2

	LEVEL			
	A	B1	B2	B3
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering.				
11.14 Lights (ATA 33)	2	2	-	2
External: navigation, anti collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.				
11.15 Oxygen (ATA 35)	1	3	-	2
System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings;				
11.16 Pneumatic/Vacuum (ATA 36)	1	3	-	2
System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure and vacuum pumps Pressure control; Distribution; Indications and warnings; Interfaces with other systems.				
11.17 Water/Waste (ATA 38)	2	3	-	-
Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.				
11.18 Electrical engine / jet engine (for motor-powered sailplanes)	-	-	-	2
Electrical propulsion				
Battery system Propulsion interface Retraction system				
Jet propulsion				
Fuel system Propulsion interface Retraction system				

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS

	LEVEL		
	A	B1	B2
12.1 Theory of Flight — Rotary Wing Aerodynamics Terminology; Effects of gyroscopic precession; Torque reaction and directional control; Dissymmetry of lift, Blade tip stall; Translating tendency and its correction; Coriolis effect and compensation; Vortex ring state, power settling, overpitching; Auto-rotation; Ground effect.	1	2	-
12.2 Flight Control Systems Cyclic control; Collective control; Swashplate; Yaw control: Anti-Torque Control, Tail rotor, bleed air; Main Rotor Head: Design and Operation features; Blade Dampers: Function and construction; Rotor Blades: Main and tail rotor blade construction and attachment; Trim control, fixed and adjustable stabilisers; System operation: manual, hydraulic, electrical and fly-bywire; Artificial feel; Balancing and Rigging.	2	3	-
12.3 Blade Tracking and Vibration Analysis Rotor alignment; Main and tail rotor tracking; Static and dynamic balancing; Vibration types, vibration reduction methods; Ground resonance.	1	3	-
12.4 Transmissions Gear boxes, main and tail rotors; Clutches, free wheel units and rotor brake.	1	3	-
12.5 Airframe Structures (a)	2	2	-

	LEVEL		
	A	B1	B2
Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision.			
(b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning and anti-corrosive protection. Pylon, stabiliser and undercarriage attachments; Seat installation; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction; Fuel storage; Firewalls; Engine mounts; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning. Airframe symmetry: methods of alignment and symmetry checks.	1	2	-
12.6 Air Conditioning (ATA 21) <i>12.6.1 Air supply</i> Sources of air supply including engine bleed and ground cart;	1	2	-
<i>12.6.2 Air Conditioning</i> Air conditioning systems; Distribution systems; Flow and temperature control systems; Protection and warning devices.	1	3	-
12.7 Instruments/Avionic Systems <i>12.7.1 Instrument Systems (ATA 31)</i> Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; Vibration indicating systems — HUMS; Other aircraft system indication.	1	2	-

	LEVEL		
	A	B1	B2
12.7.2 Avionic Systems Fundamentals of system layouts and operation of: Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).	1	1	-
12.8 Electrical Power (ATA 24) Batteries Installation and Operation; DC power generation, AC power generation; Emergency power generation; Voltage regulation, Circuit protection. Power distribution; Inverters, transformers, rectifiers; External/Ground power.	1	3	-
12.9 Equipment and Furnishings (ATA 25) (a) Emergency equipment requirements; Seats, harnesses and belts; Lifting systems.	2	2	-
(b) Emergency flotation systems; Cabin lay-out, cargo retention; Equipment lay-out; Cabin Furnishing Installation.	1	1	-
12.10 Fire Protection (ATA 26) Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.	1	3	-
12.11 Fuel Systems (ATA 28) System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling.	1	3	-
12.12 Hydraulic Power (ATA 29)	1	3	-

	LEVEL		
	A	B1	B2
System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.			
12.13 Ice and Rain Protection (ATA 30)	1	3	-
Ice formation, classification and detection; Anti-icing and de-icing systems: electrical, hot air and chemical; Rain repellant and removal; Probe and drain heating.			
12.14 Landing Gear (ATA 32)	2	3	-
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, tyres, brakes; Steering; Skids, floats.			
12.15 Lights (ATA 33)	2	3	-
External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.			
12.16 Pneumatic/Vacuum (ATA 36)	1	3	-
System lay-out; Sources: engine, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.			
12.17. Integrated Modular Avionics (ATA42)	1	2	-
Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others: Bleed Management, Air Pressure Control, Air Ventilation and Control, Avionics and Cockpit Ventilation Control, Temperature Control, Air Traffic Communication, Avionics Communication Router, Electrical Load Management, Circuit Breaker Monitoring, Electrical System BITE, Fuel Management, Braking Control, Steering Control, Landing Gear Extension and Retraction, Tyre Pressure Indication, Oleo Pressure Indication, Brake Temperature Monitoring, etc.			

	LEVEL		
	A	B1	B2
12.18. On Board Maintenance Systems (ATA45)	1	2	-
Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring)			
12.19. Information Systems such as Air Traffic and Information Management Systems and Network Server Systems (ATA46)	1	2	-

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS

	LEVEL		
	A	B1	B2
13.1 Theory of Flight			
<i>(a) Aeroplane Aerodynamics and Flight Controls</i>	-	-	1
Operation and effect of:			
— roll control: ailerons and spoilers;			
— pitch control: elevators, stabilators, variable incidence stabilisers and canards;			
— yaw control, rudder limiters;			
Control using elevons, ruddervators;			
High lift devices: slots, slats, flaps;			
Drag inducing devices: spoilers, lift dumpers, speed brakes;			
Operation and effect of trim tabs, servo tabs, control surface bias.			
<i>(b) High Speed Flight</i>	-	-	1
Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.			
<i>(c) Rotary Wing Aerodynamics</i>	-	-	1
Terminology;			
Operation and effect of cyclic, collective and anti-torque controls.			
13.2 Structures – General Concepts			
<i>(a)</i>	-	-	1
Fundamentals of structural systems.			
<i>(b)</i>	-	-	2
Zonal and station identification systems;			
Electrical bonding;			
Lightning strike protection provision.			
13.3 Autoflight (ATA 22)	-	-	3

	LEVEL		
	A	B1	B2
Fundamentals of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface; Autothrottle systems. Automatic Landing Systems: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.			
13.4 Communication/Navigation (ATA 23/34) Fundamentals of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; Working principles of following systems: — Very High Frequency (VHF) communication; — High Frequency (HF) communication; — Audio; — Emergency Locator Transmitters; — Cockpit Voice Recorder; — Very High Frequency omnidirectional range (VOR); — Automatic Direction Finding (ADF); — Instrument Landing System (ILS); — Microwave Landing System (MLS); — Flight Director systems; Distance Measuring Equipment (DME); — Very Low Frequency and hyperbolic navigation (VLF/ Omega); — Doppler navigation; — Area navigation, RNAV systems; — Flight Management Systems; — Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS); — Inertial Navigation System; — Air Traffic Control transponder, secondary surveillance radar; — Traffic Alert and Collision Avoidance System (TCAS); — Weather avoidance radar; — Radio altimeter; — ARINC communication and reporting;	-	-	3
13.5 Electrical Power (ATA 24) Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.	-	-	3
13.6 Equipment and Furnishings (ATA 25)	-	-	3

	LEVEL		
	A	B1	B2
Electronic emergency equipment requirements; Cabin entertainment equipment.			
13.7 Flight Controls (ATA 27)			
(a)	-	-	1
Primary controls: aileron, elevator, rudder, spoiler; Trim control; Active load control; High lift devices; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks. Stall protection systems.			
(b)	-	-	3
System operation: electrical, fly by wire.			
13.8 Instrument Systems (ATA 31)	-	-	3
Classification; Atmosphere; Terminology; Pressure measuring devices and systems; Pitot static systems; Altimeters; Vertical speed indicators; Airspeed indicators; Machmeters; Altitude reporting/alerting systems; Air data computers; Instrument pneumatic systems; Direct reading pressure and temperature gauges; Temperature indicating systems; Fuel quantity indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems; Compass systems; Flight Data Recording systems; Electronic Flight Instrument Systems; Instrument warning systems including master warning systems and centralised warning panels; Stall warning systems and angle of attack indicating systems;			

	LEVEL		
	A	B1	B2
Vibration measurement and indication.			
13.9 Lights (ATA 33)	-	-	3
External: navigation, landing, taxiing, ice;			
Internal: cabin, cockpit, cargo;			
Emergency.			
13.10 On board Maintenance Systems (ATA 45)	-	-	3
Central maintenance computers;			
Data loading system;			
Electronic library system;			
Printing;			
Structure monitoring (damage tolerance monitoring).			
13.11. Air Conditioning and Cabin Pressurisation (ATA21)	-	-	2
13.11.1. <i>Air supply</i>	-	-	3
Sources of air supply including engine bleed, APU and ground cart;			
13.11.2. <i>Air Conditioning</i>	-	-	3
Air conditioning systems;			
Air cycle and vapour cycle machines;			
Distribution systems;			
Flow, temperature and humidity control system.			
13.11.3. <i>Pressurisation</i>	-	-	3
Pressurisation systems;			
Control and indication including control and safety valves;			
Cabin pressure controllers.			
13.11.4. <i>Safety and warning devices</i>	-	-	3
Protection and warning devices.			
13.12. Fire Protection (ATA 26)			
(a)	-	-	3
Fire and smoke detection and warning systems;			
Fire extinguishing systems;			
System tests.			
(b)	-	-	1
Portable fire extinguisher			
13.13. Fuel Systems (ATA 28)	-	-	3
System lay-out;			
Fuel tanks;			
Supply systems;			
Dumping, venting and draining;			
Cross-feed and transfer;			

	LEVEL		
	A	B1	B2
Indications and warnings; Refuelling and defuelling; Longitudinal balance fuel systems.			
13.14. Ice and Rain Protection (ATA 30)	-	-	3
Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, hot air, pneumatic and chemical; Rain repellent; Probe and drain heating. Wiper systems			
13.15. Integrated Modular Avionics (ATA42)	-	-	3
Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others: Bleed Management, Air Pressure Control, Air Ventilation and Control, Avionics and Cockpit Ventilation Control, Temperature Control, Air Traffic Communication, Avionics Communication Router, Electrical Load Management, Circuit Breaker Monitoring, Electrical System BITE, Fuel Management, Braking Control, Steering Control, Landing Gear Extension and Retraction, Tyre Pressure Indication, Oleo Pressure Indication, Brake Temperature Monitoring, etc.			
13.16. Cabin Intercommunication Data Systems (ATA44)	-	-	3
These systems provide an interface between cockpit/cabin crew and cabin systems. These systems support data exchange of the different related LRU's and they are typically operated via Flight Attendant Panels.			
13.17. Cabin Network Service (ATA44)	-	-	3
Typically consists on a server, typically interfacing with, among others, the following systems: - Data/Radio Communication, In-Flight Entertainment System. The Cabin Network Service may host functions such as: - Access to pre-departure/departure reports, - E-mail/intranet/internet access, - Passenger database,			
13.18. Information Systems such as Air Traffic and Information Management Systems and Network Server Systems (ATA46)	-	-	3
13.19. Indications and warnings	-	-	3
Hydraulic system; Landing Gear; Oxygen; Pneumatic / Vacuum;			

MODULE 14. PROPULSION

LEVEL		
A	B1	B2

	LEVEL		
	A	B1	B2
14.1 Turbine Engines (a) Constructional arrangement and operation of turbojet, turbofan, turboshaft and turbopropeller engines; (b) Electronic Engine control and fuel metering systems (FADEC).	-	-	1
14.2 Engine Indicating Systems Exhaust gas temperature/Interstage turbine temperature systems; Engine speed; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure, temperature and flow; Manifold pressure; Engine torque; Propeller speed.	-	-	2

MODULE 15. GAS TURBINE ENGINE

	LEVEL		
	A	B1	B2
15.1 Fundamentals Potential energy, kinetic energy, Newton's laws of motion, Brayton cycle; The relationship between force, work, power, energy, velocity, acceleration; Constructional arrangement and operation of turbojet, turbofan, turboshaft, turboprop.	1	2	-
15.2 Engine Performance Gross thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust, thrust horsepower, equivalent shaft horsepower, specific fuel consumption; Engine efficiencies; By-pass ratio and engine pressure ratio; Pressure, temperature and velocity of the gas flow; Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.	-	2	-
15.3 Inlet Compressor inlet ducts Effects of various inlet configurations; Ice protection.	2	2	-
15.4 Compressors	1	2	-

	LEVEL		
	A	B1	B2
Axial and centrifugal types; Constructional features and operating principles and applications; Fan balancing; Operation: Causes and effects of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ratio.			
15.5 Combustion Section Constructional features and principles of operation.	1	2	-
15.6 Turbine Section Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes; Causes and effects of turbine blade stress and creep.	2	2	-
15.7 Exhaust Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.	1	2	-
15.8 Bearings and Seals Constructional features and principles of operation.	-	2	-
15.9 Lubricants and Fuels Properties and specifications; Fuel additives; Safety precautions.	1	2	-
15.10 Lubrication Systems System operation/lay-out and components.	1	2	-
15.11 Fuel Systems Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.	1	2	-
15.12 Air Systems Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.	1	2	-
15.13 Starting and Ignition Systems Operation of engine start systems and components; Ignition systems and components; Maintenance safety requirements.	1	2	-
15.14 Engine Indication Systems	1	2	-

	LEVEL		
	A	B1	B2
Exhaust Gas Temperature/Interstage Turbine Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication; Torque; Power.			
15.15 Power Augmentation Systems Operation and applications; Water injection, water methanol; Afterburner systems.	-	1	-
15.16 Turbo-prop Engines Gas coupled/free turbine and gear coupled turbines; Reduction gears; Integrated engine and propeller controls; Overspeed safety devices.	1	2	-
15.17 Turbo-shaft engines Arrangements, drive systems, reduction gearing, couplings, control systems.	1	2	-
15.18 Auxiliary Power Units (APUs) Purpose, operation, protective systems.	1	2	-
15.19 Powerplant Installation Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains	1	2	-
15.20 Fire Protection Systems Operation of detection and extinguishing systems.	1	2	-
15.21 Engine Monitoring and Ground Operation Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring; Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer; Compressor washing/cleaning; Foreign Object Damage.	1	3	-
15.22 Engine Storage and Preservation Preservation and depreservation for the engine and accessories/systems.	-	2	-

MODULE 16. PISTON ENGINE

LEVEL

	A	B1	B2	B3
16.1 Fundamentals Mechanical, thermal and volumetric efficiencies; Operating principles — 2 stroke, 4 stroke, Otto and Diesel; Piston displacement and compression ratio; Engine configuration and firing order.	1	2	-	2
16.2 Engine Performance Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.	1	2	-	2
16.3 Engine Construction Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; Propeller reduction gearboxes.	1	2	-	2
16.4 Engine Fuel Systems <i>16.4.1 Carburettors</i> Types, construction and principles of operation; Icing and heating.	1	2	-	2
<i>16.4.2 Fuel injection systems</i> Types, construction and principles of operation.	1	2	-	2
<i>16.4.3 Electronic engine control</i> Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.	1	2	-	2
16.5 Starting and Ignition Systems Starting systems, pre-heat systems; Magneto types, construction and principles of operation; Ignition harnesses, spark plugs; Low and high tension systems.	1	2	-	2
16.6 Induction, Exhaust and Cooling Systems Construction and operation of: induction systems including alternate air systems; Exhaust systems, engine cooling systems — air and liquid.	1	2	-	2
16.7 Supercharging/Turbocharging	1	2	-	2

	LEVEL			
	A	B1	B2	B3
Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/turbocharging systems; System terminology; Control systems; System protection.				
16.8 Lubricants and Fuels	1	2	-	2
Properties and specifications; Fuel additives; Safety precautions.				
16.9 Lubrication Systems	1	2	-	2
System operation/lay-out and components.				
16.10 Engine Indication Systems	1	2	-	2
Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.				
16.11 Powerplant Installation	1	2	-	2
Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.				
16.12 Engine Monitoring and Ground Operation	1	3	-	2
Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer.				
16.13 Engine Storage and Preservation	-	2	-	1
Preservation and depreservation for the engine and accessories/systems.				

MODULE 17. PROPELLER

	LEVEL			
	A	B1	B2	B3
17.1 Fundamentals	1	2	-	2

	LEVEL			
	A	B1	B2	B3
Blade element theory; High/low blade angle, reverse angle, angle of attack, rotational speed; Propeller slip; Aerodynamic, centrifugal, and thrust forces; Torque; Relative airflow on blade angle of attack; Vibration and resonance.				
17.2 Propeller Construction	1	2	-	2
Composite and metal propellers; Blade station, blade face, blade shank, blade back and hub assembly; Fixed pitch, controllable pitch, constant speed propeller; Propeller/spinner installation.				
17.3 Propeller Pitch Control	1	2	-	2
Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Overspeed protection.				
17.4 Propeller Synchronising	-	2	-	2
Synchronising and synchrophasing equipment.				
17.5 Propeller Ice Protection	1	2	-	2
Fluid and electrical de-icing equipment.				
17.6 Propeller Maintenance	1	3	-	2
Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.				
17.7 Propeller Storage and Preservation	1	2	-	2
Propeller preservation and depreservation.				

B/ Second part:

Appendix II to Part 66

Basic Examination Standard

1. Standardisation Basis For Examinations

1.1. All basic examinations must be carried out using the multi-choice question format and essay questions as specified below. The incorrect alternatives must seem equally plausible to anyone ignorant of the subject. All of the alternatives should be clearly related to the question and of similar vocabulary, grammatical construction and length. In numerical questions, the incorrect answers should correspond to procedural errors such as corrections applied in the wrong sense or incorrect unit conversions: they must not be mere random numbers.

1.2. Each multi-choice question must have three alternative answers of which only one must be the correct answer and the candidate must be allowed a time per module which is based upon a nominal average of 75 seconds per question.

1.3. Each essay question requires the preparation of a written answer and the candidate must be allowed 20 minutes to answer each such question.

1.4. Suitable essay questions must be drafted and evaluated using the knowledge syllabus in Part-66 Appendix I Modules 7, 9 and 10.

1.5. Each question will have a model answer drafted for it, which will also include any known alternative answers that may be relevant for other subdivisions.

1.6. The model answer will also be broken down into a list of the important points known as Key Points.

1.7. The pass mark for each Part-66 module and sub-module multi-choice part of the examination is 75 %.

1.8. The pass mark for each essay question is 75 % in that the candidates answer must contain 75 % of the required key points addressed by the question and no significant error related to any required key point.

1.9. If either the multi-choice part only or the essay part only is failed, then it is only necessary to retake the multichoice or essay part, as appropriate.

1.10. Penalty marking systems must not be used to determine whether a candidate has passed.

1.11. All Part-66 modules that make up a complete Part-66 aircraft maintenance licence category or subcategory must be passed within a 5 year time period of passing the first module except in the case specified in paragraph 1.12.

A failed module may not be retaken for at least 90 days following the date of the failed module examination, except in the case of a Part-147 approved maintenance training organisation which conducts a course of retraining tailored to the failed subjects in the particular module when the failed module may be retaken after 30 days.

1.12. The 5 year time period specified in paragraph 1.11 does not apply to those modules which are common to more than one Part-66 aircraft maintenance licence category or subcategory and which were previously passed as part of another such category or subcategory examination.

2. Question Numbers for the Part-66 Appendix I Modules

2.1. Subject Module 1 Mathematics:

Category A-16 multi-choice and 0 essay questions. Time allowed 20 minutes.

Category B1-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

Category B2-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

Category B3-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

2.2. Subject Module 2 Physics:

Category A-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

Category B1-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B2-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B3-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

2.3. Subject Module 3 Electrical Fundamentals:

Category A- 0 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B1-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B2-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B3-23 multi-choice and 0 essay questions. Time allowed 30 minutes.

2.4. Subject Module 4 Electronic Fundamentals:

Category A-None.

Category B1-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B2-40 multi-choice and 0 essay questions. Time allowed 50 minutes.

Category B3-9 multi-choice and 0 essay questions. Time allowed 12 minutes.

2.5. Subject Module 5 Digital Techniques/Electronic Instrument Systems:

Category A-16 multi-choice and 0 essay questions. Time allowed 20 minutes.

Category B1.1 & B1.3-40 multi-choice and 0 essay questions. Time allowed 50 minutes.

Category B1.2 & B1.4-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B2-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

Category B3-16 multi-choice and 0 essay questions. Time allowed 20 minutes.

2.6. Subject Module 6 Materials and Hardware:

Category A-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B1-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

Category B2-60 multi-choice and 0 essay questions. Time allowed 75 minutes.

Category B3-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

2.7. Subject Module 7 Maintenance Practices:

Category A-70 multi-choice and 2 essay questions. Time allowed 90 minutes plus 40 minutes.

Category B1-80 multi-choice and 2 essay questions. Time allowed 100 minutes plus 40 minutes.

Category B2-60 multi-choice and 2 essay questions. Time allowed 75 minutes plus 40 minutes.

Category B3-80 multi-choice and 2 essay questions. Time allowed 100 minutes plus 40 minutes.

2.8. Subject Module 8 Basic Aerodynamics:

Category A-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B1-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B2-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B3-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

2.9. Subject Module 9 Human factors:

Category A-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.

Category B1-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.

Category B2-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.

Category B3-20 multi-choice and 1 essay questions. Time allowed 25 minutes plus 20 minutes.

2.10. Subject Module 10 Aviation Legislation:

Category A-30 multi-choice and 1 essay question. Time allowed 40 minutes plus 20 minutes.

Category B1-40 multi-choice and 1 essay question. Time allowed 50 minutes plus 20 minutes.

Category B2-40 multi-choice and 1 essay question. Time allowed 50 minutes plus 20 minutes.

Category B3-40 multi-choice and 1 essay questions. Time allowed 50 minutes plus 20 minutes.

2.11. Subject Module 11a Turbine Aeroplane Aerodynamics, Structures and Systems:

Category A-108 multi-choice and 0 essay questions. Time allowed 135 minutes.

Category B1-140 multi-choice and 0 essay questions. Time allowed 175 minutes.

Category B2-None.

2.12. Subject Module 11b Piston Aeroplane Aerodynamics, Structures and Systems:

Category A-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

Category B1-100 multi-choice and 0 essay questions. Time allowed 125 minutes.

Category B2-None.

Category B3-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

2.13. Subject Module 12 Helicopter Aerodynamics, Structures and Systems:

Category A-100 multi-choice and 0 essay questions. Time allowed 125 minutes.

Category B1-128 multi-choice and 0 essay questions. Time allowed 160 minutes.

Category B2-None.

2.14. Subject Module 13 Aircraft Aerodynamics, Structures and Systems:

Category A-None.

Category B1-None.

Category B2-160 multi-choice and 0 essay questions. Time allowed 200 minutes.

2.15. Subject Module 14 Propulsion:

Category A-None.

Category B1-None.

Category B2-25 multi-choice and 0 essay questions. Time allowed 30 minutes.

2.16. Subject Module 15 Gas Turbine Engine:

Category A-60 multi-choice and 0 essay questions. Time allowed 75 minutes.

Category B1-90 multi-choice and 0 essay questions. Time allowed 115 minutes.

Category B2-None.

2.17. Subject Module 16 Piston Engine:

Category A-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

Category B1-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

Category B2-None.

Category B3-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

2.18. Subject Module 17 Propeller:

Category A-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

Category B1-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

Category B2-None.

Category B3-30 multi-choice and 0 essay questions. Time allowed 40 minute

