

Advisory Circular

SAR-66 BASIC EXAMINATIONS

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GENERAL

Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 11 of the Air Navigation Act 1966 (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE

This AC provides guidance to demonstrate compliance with, and information related to requirements regarding the SAR-66 basic examinations.

APPLICABILITY

This AC is applicable to a person who intends to take a SAR-66 aircraft maintenance licence (AML) examination.

RELATED REGULATIONS

This AC relates specifically to:

- SAR-66.25 on Basic Knowledge Requirements;
- SAR 66 Appendix 1 on SAR-66 AML Examination Module; and
- SAR 66 Appendix 2 on Basic Examination Standard

CANCELLATION

This AC supersedes AC 66-13 (Rev 1). In this revision 1, editorial amendments are made to the paragraph under “General” and the table in paragraph 3.3.

EFFECTIVE DATE

This AC is effective on 9 March 2022.

1. INTRODUCTION

- 1.1 This AC provides information to a person who intends to sit for a SAR-66 AML examination on the basic knowledge requirements, the basic examination syllabi, and the configuration of the examination papers (i.e. the number of questions and the time allocated for each paper).

2. BASIC EXAMINATION SYLLABI AND KNOWLEDGE LEVEL

- 2.1 The basic examination syllabi is shown in **Appendix A**. The requisite knowledge levels for each category – Category A, B1 and B2 AML – are indicated by the knowledge level indicators (i.e. 1, 2 or 3) against each applicable subject. Category C AML 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:

- (i) familiar with the basic elements of the subject;
- (ii) able to give a simple description of the whole subject, using common words and examples; and
- (iii) 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:

- (i) understand the theoretical fundamentals of the subject;
- (ii) give a general description of the subject using, as appropriate, typical examples;
- (iii) use mathematical formulae in conjunction with physical laws describing the subject;
- (iv) read and understand sketches, drawings and schematics describing the subject; and
- (v) apply his or her 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:

- (i) know the theory of the subject and interrelationships with other subjects;
- (ii) be able to give a detailed description of the subject using theoretical fundamentals and specific examples;
- (iii) understand and be able to use mathematical formulae related to the subject;
- (iv) be able to read, understand and prepare sketches, simple drawings and schematics describing the subject;
- (v) be able to apply his knowledge in a practical manner using manufacturer's instructions; and
- (vi) be able to interpret results from various sources and measurements and apply corrective action where appropriate.

3. CONFIGURATION OF BASIC EXAMINATION PAPERS

3.1 The number of multiple-choice questions (MCQs) and time allocated for each SAR-66 basic examination module are as follows:

Module No.	Module Name	Cat A		Cat B1		Cat B2	
		No. of Questions	Time Allocation	No. of Questions	Time Allocation	No. of Questions	Time Allocation
M01	Mathematics	16	20 mins	32	40 mins	32	40 mins
M02	Physics	32	40 mins	52	65 mins	52	65 mins
M03	Electrical Fundamentals	20	25 mins	52	65 mins	52	65 mins
M04	Electronic Fundamentals	-	-	20	25 mins	40	50 mins
M05	Digital Techniques / Electronic Instrument Systems	16	20 mins	40 (B1.1 & B1.3)	50 mins	72	90 mins
				20 (B1.2 & B1.4)	25 mins		
M06	Materials and Hardware	52	65 mins	72	90 mins	60	75 mins
M07	Maintenance Practices	72	90 mins	80	100 mins	60	75 mins
M08	Basic Aerodynamics	20	25 mins	20	25 mins	20	25 mins
M09	Human Factors	20	25 mins	20	25 mins	20	25 mins
M10	Aviation Legislation	40	50 mins	40	50 mins	40	50 mins
M11A*	Turbine Aeroplane Aerodynamics, Structures and Systems	108	135 mins	140	175 mins	-	-
M11B	Piston Aeroplane Aerodynamics,	72	90 mins	100	125 mins	-	-

Module No.	Module Name	Cat A		Cat B1		Cat B2	
		No. of Questions	Time Allocation	No. of Questions	Time Allocation	No. of Questions	Time Allocation
	Structures and Systems						
M12*	Helicopter Aerodynamics, Structures and Systems	100	125 mins	128	160 mins	-	-
M13*	Aircraft Aerodynamics, Structures and Systems	-	-	-	-	180	225 mins
M14	Propulsion	-	-	-	-	24	30 mins
M15	Gas Turbine Engine	60	75 mins	92	115 mins	-	-
M16	Piston Engine	52	65 mins	72	90 mins	-	-
M17	Propeller	20	25 mins	32	40 mins	-	-

* Please see paragraph 3.3 for changes to the examination configuration that will apply to the Category B modules from 1 November 2022.

3.2 The essay examination paper (M50), comprises two questions from the syllabus of Module 07, and one question each from the syllabi of Module 09 and Module 10. This is a common paper set to the same syllabi and standard across all the AML categories. The number of questions and time allocated for the SAR-66 essay examination (M50) are as follows:

Exam Module no.	Module Name	Cat A		Cat B1		Cat B2	
		No. of Questions	Time Allocation	No. of Questions	Time Allocation	No. of Questions	Time Allocation
M50	Essay Examination Paper	4	120 mins	4	120 mins	4	120 mins

3.3 From 1 November 2022, the configuration of Category B modules M11A, M12 and M13 will be changed from a single module each to a two-part module each, e.g. M11A will be split into M11A Part 1 and M11A Part 2. The examination for each part has to be booked and sat for as a separate paper, and a candidate has to pass both parts in order to obtain a pass in the corresponding module. The new configuration of these modules will be as follows:

Module Name	Module No. (Topics)	Cat B1		Cat B2	
		No. of Questions	Time Allocation	No. of Questions	Time Allocation
Turbine Aeroplane Aerodynamics, Structures and Systems	M11A Part 1 (11.1 – 11.8)	80	100 mins	-	-
	M11A Part 2 (11.9 – 11.21)	60	75 mins	-	-
Helicopter Aerodynamics, Structures and Systems	M12 Part 1 (12.1 – 12.6)	56	70 mins	-	-
	M12 Part 2 (12.7 – 12.19)	72	90 mins	-	-
Aircraft Aerodynamics, Structures and Systems	M13 Part 1 (13.1 – 13.6)	-	-	92	115 mins
	M13 Part 2 (13.7 – 13.22)	-	-	88	110 mins

Appendix A: BASIC EXAMINATION SYLLABI

1. The basic examination Syllabi are detailed as follows:

MODULE 1. MATHEMATICS

		Level		
		A	B1	B2
1.1	<p>Arithmetic</p> <p>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.</p>	1	2	2
1.2	<p>Algebra</p> <p>(a) Evaluating simple algebraic expressions, addition, subtraction, multiplication and division, use of brackets, simple algebraic fractions.</p> <p>(b)</p> <p>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.</p>	1 -	2 1	2 1
1.3	<p>Geometry</p> <p>(a) Simple geometrical constructions.</p> <p>(b) Graphical representation; nature and uses of graphs, graphs of equations/functions.</p> <p>(c) Simple trigonometry; trigonometrical relationships, use of tables and rectangular and polar co-ordinates.</p>	- 2 -	1 2 2	1 2 2

MODULE 2. PHYSICS

Students should become conversant with Metric, Imperial (British) and US units and measurements.

		Level		
		A	B1	B2
2.1	<p>Matter</p> <p>Nature of matter: the chemical elements, structure of atoms, molecules Chemical compounds. States: solid, liquid and gaseous; Changes between states.</p>	1	1	1
2.2	<p>Mechanics</p>			

MODULE 2. PHYSICS (Continued)

Students should become conversant with Metric, Imperial (British) and US units and measurements.

		Level		
		A	B1	B2
2.2.1	Statics 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).	1	2	1
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
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 1	2 2	1 2
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 1	2 2	2 1
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; Latent heats of fusion and evaporation, thermal energy, heat of combustion.	2 -	2 2	2 2

MODULE 2. PHYSICS (Continued)

Students should become conversant with Metric, Imperial (British) and US units and measurements.

		Level		
		A	B1	B2
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
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
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
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
3.4	Generation of Electricity Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.	1	1	1
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
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
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

MODULE 3. ELECTRICAL FUNDAMENTALS (Continued)

		Level		
		A	B1	B2
3.7	<p>(b)</p> <p>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.</p>	-	1	1
3.8	<p>Power</p> <p>Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.</p>	-	2	2
3.9	<p>Capacitance / Capacitor</p> <p>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.</p>	-	2	2
3.10	<p>Magnetism</p> <p>(a)</p> <p>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.</p> <p>(b)</p> <p>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.</p>	-	2	2

MODULE 3. ELECTRICAL FUNDAMENTALS (Continued)

		Level		
		A	B1	B2
3.11	<p>Inductance / Inductor</p> <p>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; Principal uses of inductors.</p>	-	2	2
3.12	<p>DC Motor / Generator Theory</p> <p>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.</p>	-	2	2
3.13	<p>AC Theory</p> <p>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.</p>	1	2	2
3.14	<p>Resistive (R), Capacitive (C) and Inductive (L) Circuits</p> <p>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.</p>	-	2	2

MODULE 3. ELECTRICAL FUNDAMENTALS (Continued)

		Level		
		A	B1	B2
3.15	<p>Transformers</p> <p>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.</p>	-	2	2
3.16	<p>Filters</p> <p>Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.</p>	-	1	1
3.17	<p>AC Generators</p> <p>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.</p>	-	2	2
3.18	<p>AC Motors</p> <p>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.</p>	-	2	2

MODULE 4. ELECTRONIC FUNDAMENTALS

		Level		
		A	B1	B2
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
	(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
	(b) 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.	-	-	2
	4.1.3 Integrated Circuits			
	(a) Description and operation of logic circuits and linear circuits/operational amplifiers.	-	1	-

MODULE 4. ELECTRONIC FUNDAMENTALS (Continued)

		Level		
		A	B1	B2
4.1.3	(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.	-	-	2
4.2	Printed Circuit Board Description and use of printed circuit boards.	-	1	2
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.	-	1	-
	(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.	-	-	2

MODULE 5. DIGITAL TECHNIQUES / ELECTRONIC INSTRUMENT SYSTEMS

		Level			
		A	B1.1 B 1.3	B1.2 B1.4	B2
5.1	Electronic Instrument Systems Typical systems arrangements and cockpit layout of electronic instrument systems.	1	2	2	3
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. Aircraft Network / Ethernet	-	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

MODULE 5. DIGITAL TECHNIQUES / ELECTRONIC INSTRUMENT SYSTEMS (Continued)

		Level			
		A	B1.1 B 1.3	B1.2 B1.4	B2
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
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
5.13	Software Management Control Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes.	-	2	1	2
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

MODULE 5. DIGITAL TECHNIQUES / ELECTRONIC INSTRUMENT SYSTEMS (Continued)

	Level			
	A	B1.1 B 1.3	B1.2 B1.4	B2
<p>5.15 Typical Electronic / Digital Aircraft Systems</p> <p>General arrangement of typical electronic/digital aircraft systems and associated BITE</p> <p>(Built In Test Equipment) testing such as:</p> <ul style="list-style-type: none"> 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 Integrated Modular Avionics Cabin Systems Information Systems <p>Note: Different manufacturers may use different terminology for similar systems.</p>	-	2	2	2

MODULE 6. MATERIALS AND HARDWARE

		Level		
		A	B1	B2
6.1	Aircraft Materials – Ferrous			
	(a) Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels.	1	2	1
	(b) Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.	-	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
	(b) Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.	-	1	1
6.3	Aircraft Materials – Composite and Non-Metallic			
	6.3.1 Composite and non-metallic other than wood and fabric			
	(a) Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents.	1	2	2
	(b) The detection of defects/deterioration in composite and non-metallic material; Repair of composite and non-metallic material.	1	2	-
	6.3.2 Wooden structures Reserved	-	-	-
	6.3.3 Fabric covering Reserved	-	-	-
6.4	Corrosion			
	(a) Chemical fundamentals; Formation by, galvanic action process, microbiological, stress.	1	1	1
	(b) Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.	2	3	2

MODULE 6. MATERIALS AND HARDWARE (Continued)

		Level		
		A	B1	B2
6.5	Fasteners			
6.5.1	Screw Threads Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; Measuring screw threads.	2	2	2
6.5.2	Bolts, studs and screws Bolt types: specification, identification and marking of aircraft bolts, international standards; Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.	2	2	2
6.5.3	Locking Devices Tab and spring washers, locking plates, split pins, pal-nuts, wire locking, quick release fasteners, keys, circlips, cotter pins.	2	2	2
6.5.4	Aircraft Rivets Types of solid and blind rivets: specifications and identification, heat treatment.	1	2	1
6.6	Pipes and Unions			
	(a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft.	2	2	2
	(b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.	2	2	1
6.7	Springs Types of springs, materials, characteristics and applications.	-	2	1
6.8	Bearings Purpose of bearings, loads, material, construction; Types of bearings and their application.	1	2	2
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.	1	2	2

MODULE 6. MATERIALS AND HARDWARE (Continued)

		Level		
		A	B1	B2
6.10	Control Cables Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.	1	2	1
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.	1	2	2

MODULE 7. MAINTENANCE PRACTICES

		Level		
		A	B1	B2
7.1	<p>Safety Precautions – Aircraft and Workshop</p> <p>Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals.</p> <p>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 the extinguishing agents.</p>	3	3	3
7.2	<p>Workshop Practices</p> <p>Care of tools, control of tools, use of workshop materials; Dimensions, allowances and tolerances, standards of workmanship; Calibration of tools and equipment, calibration standards.</p>	3	3	3
7.3	<p>Tools</p> <p>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.</p>	3	3	3
7.4	<p>Avionic General Test Equipment</p> <p>Operation, function and use of avionic general test equipment.</p>	-	2	3
7.5	<p>Engineering Drawings, Diagrams and Standards</p> <p>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.</p>	1	2	2
7.6	<p>Fits and Clearances</p> <p>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.</p>	1	2	1

MODULE 7. MAINTENANCE PRACTICES (Continued)

		Level		
		A	B1	B2
7.7	<p>Electrical Wiring Interconnection System (EWIS) 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; Identification of wire types, their inspection criteria and damage tolerance. Wiring protection techniques : Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding. EWIS installations, inspection, repair, maintenance and cleanliness standards.</p>	1	3	3
7.8	<p>Riveting Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.</p>	1	2	-
7.9	<p>Pipes and Hoses Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.</p>	1	2	-
7.10	<p>Springs Inspection and testing of springs.</p>	1	2	-
7.11	<p>Bearings Testing, cleaning and inspection of bearings; Lubrication requirements of bearings; Defects in bearings and their causes.</p>	1	2	-
7.12	<p>Transmissions Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push-pull rod systems.</p>	1	2	-
7.13	<p>Control Cables Swaging of end fittings; Inspection and testing of control cables; Bowden cables; aircraft flexible control systems.</p>	1	2	-

MODULE 7. MAINTENANCE PRACTICES (Continued)

		Level		
		A	B1	B2
7.14	Material Handling			
	7.14.1 Sheet Metal Work Marking out and calculation of bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.	-	2	-
	7.14.2 Composite and non-metallic Bonding practices; Environmental conditions; Inspection methods.	-	2	-
7.15	Welding, Brazing, Soldering and Bonding			
	(a) Soldering methods; inspection of soldered joints.	-	2	2
7.15	(b) Welding and brazing methods; Inspection of welded and brazed joints; Bonding methods and inspection of bonded joints.	-	2	-
7.16	Aircraft Weight and Balance			
	(a) Centre of Gravity / Balance limits calculation: use of relevant documents.	-	2	2
	(b) Preparation of aircraft for weighing; Aircraft weighing.	-	2	-
7.17	Aircraft Handling and Storage Aircraft 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.	2	2	2

MODULE 7. MAINTENANCE PRACTICES (Continued)

		Level		
		A	B1	B2
7.18	Disassembly, Inspection, Repair and Assembly Techniques			
	(a) Types of defects and visual inspection techniques; Corrosion removal, assessment and re-protection.	2	3	3
	(b) General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes.	-	2	-
	(c) Non-destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods.	-	2	1
	(d) Disassembly and re-assembly techniques.	2	2	2
	(e) Troubleshooting techniques.	-	2	2
7.19	Abnormal Events			
	(a) Inspections following lightning strikes and HIRF penetration.	2	2	2
	(b) Inspections following abnormal events such as heavy landings and flight through turbulence.	2	2	-
7.20	Maintenance Procedures	1	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
8.1	Physics of the Atmosphere International Standard Atmosphere (ISA), application to aerodynamics.	1	2	2
8.2	Aerodynamics 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.	1	2	2
8.3	Theory of Flight 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.	1	2	2
8.4	Flight Stability and Dynamics Longitudinal, lateral and directional stability (active and passive).	1	2	2

MODULE 9. HUMAN FACTORS

		Level		
		A	B1	B2
9.1	General The need to take human factors into account; Incidents attributable to human factors / human error; 'Murphy's' law.	2	2	2
9.2	Human Performance and Limitations Vision; Hearing; Information processing; Attention and perception; Memory; Claustrophobia and physical access.	2	2	2
9.3	Social Psychology Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.	1	1	1
9.4	Factors Affecting Performance Fitness / health; Stress: domestic and work related; Time pressure and deadlines; Workload: overload and underload; Sleep and fatigue, shiftwork; Alcohol, medication, drug abuse.	2	2	2
9.5	Physical Environment Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.	1	1	1
9.6	Tasks Physical work; Repetitive tasks; Visual inspection; Complex systems.	1	1	1

MODULE 9. HUMAN FACTORS (Continued)

		Level		
		A	B1	B2
9.7	Communication Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.	2	2	2
9.8	Human Error Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e accidents); Avoiding and managing errors.	2	2	2
9.9	Hazards in the Workplace Recognising and avoiding hazards; Dealing with emergencies.	2	2	2

MODULE 10. AVIATION LEGISLATION

		Level		
		A	B1	B2
10.1	Regulatory Framework Role of International Civil Aviation Organisation Role and responsibilities contracting states Air Navigation Act Air Navigation Order Air Navigation Regulations Singapore Airworthiness Requirements Airworthiness Notices Advisory Circulars Notices of Amendment and Information Circulars	1	1	1
10.2	SAR-21 Certification of Products and Design and Production Organisations Familiarisation and understanding of SAR-21	1	1	1
10.3	SAR-39 Airworthiness Directive Familiarisation and understanding of SAR-39	1	1	1
10.4	SAR-66 Certifying Staff – Maintenance Detailed understanding of SAR-66	2	2	2
10.5	SAR-145 Approved Maintenance Organisation Detailed understanding of SAR-145	2	2	2
10.6	SAR-147 Approval of Maintenance Training Organisation Familiarisation and understanding of SAR-147	1	1	1
10.7	Requirements on Aircraft Maintenance Maintenance Responsibility Maintenance Management Aircraft Maintenance Programme (including CMR) Aircraft Technical Log Maintenance Records and Log Books Accident / Occurrence Reporting	2	2	2
10.8	Others Minimum Equipment List / Master Minimum Equipment List Dispatch Deviation List Services Bulletins / Manufacturer Service Information Modifications and Repairs Continuing Airworthiness Test Flights ETOPS – Maintenance and dispatch requirements Any new aircraft maintenance related requirements published by CAAS	2	2	2

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

		Level		
		A1	B1.1	B2
11.1	Theory of Flight			
11.1.1	Aeroplane Aerodynamics and Flight Controls Operation and effect of: <ul style="list-style-type: none"> – 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;	1	2	-
11.1.2	High Speed Flight 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.	1	2	-
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	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.3	Airframe Structures – Aeroplanes			
11.3.1	Fuselage (ATA 52 / 53 / 56) 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	-
11.3.2	Wings (ATA 57) Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.	1	2	-
11.3.3	Stabilisers (ATA 55) Construction; Control surface attachment.	1	2	-
11.3.4	Flight Control Surfaces (ATA 55 / 57) Construction and attachment; Balancing – mass and aerodynamic.	1	2	-
11.3.5	Nacelles / Pylons (ATA 54) Construction; Firewalls; Engine mounts.	1	2	-
11.4	Air Conditioning and Cabin Pressurisation (ATA 21)			
11.4.1	Air Supply Sources of air supply including engine bleed, APU and ground cart.	1	2	-
11.4.2	Air Conditioning Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.	1	3	-
11.4.3	Pressurisation Pressurisation systems; Control and indication including control and safety valves; Cabin pressure controllers.	1	3	-
11.4.4	Safety and Warning Devices Protection and warning devices.	1	3	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.5	Instrument / Avionic Systems			
11.5.1	Instrument Systems (ATA 31) Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Glass cockpit; Other aircraft system indication.	1	2	-
11.5.2	Avionic Systems Fundamentals of system lay-outs and operation of: – Auto Flight (ATA 22); – Communications (ATA 23); – Navigation Systems (ATA 34).	1	1	-
11.6	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.	1	3	-
11.7	Equipment and Furnishings (ATA 25)			
	(a) Emergency equipment requirements; Seats, harnesses and belts.	2	2	-
	(b) Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.	1	1	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.8	Fire Protection (ATA 26) (a) Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.	1	3	-
11.8	(b) Portable fire extinguisher.	1	1	-
11.9	Flight Controls (ATA 27) 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 lock systems; Balancing and rigging; Stall protection system.	1	3	-
11.10	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; Longitudinal balance fuel systems.	1	3	-
11.11	Hydraulic Power (ATA 29) System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Filters; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.	1	3	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.12	Ice and Rain Protection (ATA 30) Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, hot air, pneumatic and chemical; Rain repellent and removal; Probe and drain heating; Wiper systems.	1	3	-
11.13	Landing Gear (ATA 32) Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering; Air-ground sensing.	2	3	-
11.14	Lights (ATA 33) External: navigation, anti-collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.	2	3	-
11.15	Oxygen (ATA 35) System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.	1	3	-
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	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.18	<p>On Board Maintenance Systems (ATA 45)</p> <p>Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).</p>	1	2	-
11.19	<p>Integrated Modular Avionics (ATA 42)</p> <p>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, and Brake Temperature Monitoring.</p> <p>Core System; Network Components.</p>	1	2	-
11.20	<p>Cabin Systems (ATA 44)</p> <p>The units and components which furnish a means of entertaining the passengers and providing communication within the aircraft (Cabin Intercommunication Data System) and between the aircraft cabin and ground stations (Cabin Network Service). These include voice, data, music and video transmissions.</p> <p>The Cabin Intercommunication Data System provides an interface between cockpit/cabin crew and cabin systems. These systems support data exchange of the different related LRUs and they are typically operated via Flight Attendant Panels.</p> <p>The Cabin Network Service typically consists on a server, typically interfacing with, among others, the following systems: (a) Data/Radio Communication; and (b) In-Flight Entertainment System.</p> <p>The Cabin Network Service may host functions such as: (a) Access to pre-departure/departure reports; (b) E-mail/intranet/internet access; and (c) Passenger database.</p> <p>Cabin Core System; In-flight Entertainment System; External Communication System; Cabin Mass Memory System; Cabin Monitoring System; Miscellaneous Cabin System.</p>	1	2	-

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A1	B1.1	B2
11.21	<p>Information Systems (ATA 46)</p> <p>The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. Includes units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller. Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display.</p> <p>Typical examples include</p> <p>Air Traffic and Information Management Systems and Network Server Systems;</p> <p>Aircraft General Information System;</p> <p>Flight Deck Information System;</p> <p>Maintenance Information System;</p> <p>Passenger Cabin Information System;</p> <p>Miscellaneous Information System.</p>	1	2	-

MODULE 11B. PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

Note: The scope of this module should reflect the technology of aeroplanes pertinent to the A2 and B1.2 subcategory

		Level		
		A2	B1.2	B2
11.1	Theory of Flight			
11.1.1	Aeroplane Aerodynamics and Flight Controls	1	2	-
	Operation and effect of: <ul style="list-style-type: none"> – 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 – N/A	-	-	-
11.2	Airframe Structures – General Concepts			
	(a)	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	-
	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.			

MODULE 11B. PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A2	B1.2	B2
11.3	Airframe Structures – Aeroplanes			
11.3.1	Fuselage (ATA 52 / 53 / 56) Construction and pressurisation sealing; Wing, stabiliser, pylon and undercarriage attachments; Seat installation; Doors and emergency exits: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.	1	2	-
11.3.2	Wings (ATA 57) Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.	1	2	-
11.3.3	Stabilisers (ATA 55) <i>Construction;</i> <i>Control</i> surface attachment.	1	2	-
11.3.4	Flight Control Surfaces (ATA 55 / 57) Construction and attachment; Balancing – mass and aerodynamic.	1	2	-
11.3.5	Nacelles / Pylons (ATA 54) Construction; Firewalls; Engine mounts.	1	2	-
11.4	Air Conditioning and Cabin Pressurisation (ATA 21) Pressurisation and air conditioning systems; Cabin pressure controllers, protection and warning devices; Heating systems.	1	3	-
11.5	Instrument / Avionic Systems			
11.5.1	Instrument Systems (ATA 31) Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Glass cockpit; Other aircraft system indication.	1	2	-
11.5.2	Avionic Systems Fundamentals of system lay-outs and operation of: Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).	1	1	-

MODULE 11B. PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A2	B1.2	B2
11.6	Electrical Power (ATA 24) Batteries Installation and Operation; DC power generation; Voltage regulation; Power distribution; Circuit protection; Inverters, transformers;	1	3	-
11.7	Equipment and Furnishings (ATA 25)			
	(a) Emergency equipment requirements; Seats, harnesses and belts.	2	2	-
	(b) Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.	1	1	-
11.8	Fire Protection (ATA 26)			
	(a) Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.	1	3	-
	(b) Portable fire extinguisher	1	3	-
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	-
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	-

MODULE 11B. PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A2	B1.2	B2
11.11	<p>Hydraulic Power (ATA 29) System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical; Filters; Pressure Control; Power distribution; Indication and warning systems.</p>	1	3	-
11.12	<p>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.</p>	1	3	-
11.13	<p>Landing Gear (ATA 32) Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering; Air-ground sensing.</p>	2	3	-
11.14	<p>Lights (ATA 33) External: navigation, anti-collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.</p>	2	3	-
11.15	<p>Oxygen (ATA 35) System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.</p>	1	3	-
11.16	<p>Pneumatic/Vacuum (ATA 36) System lay-out; Sources: engine / APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.</p>	1	3	-
11.17	<p>Water/Waste (ATA 38) Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.</p>	2	3	-

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS

		Level		
		A3 A4	B1.3 B1.4	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-by-wire; 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; Tail rotor drive shafts, flexible coupling, bearing, vibration dampers and bearing hangers.	1	3	-
12.5	Airframe Structures (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.	2	2	-

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A3 A4	B1.3 B1.4	B2
12.5	(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)			
12.6.1	Air supply Sources of air supply including engine bleed and ground cart.	1	2	-
12.6.2	Air Conditioning Air conditioning systems; Distribution systems; Flow and temperature control systems; Protection and warning devices.	1	3	-
12.7	Instruments/Avionic Systems			
12.7.1	Instrument Systems (ATA 31) Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator; Compasses: direct reading, remote reading; Vibration indicating systems – HUMS; Glass cockpit; Other aircraft system indication.	1	2	-

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A3 A4	B1.3 B1.4	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	-

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A3 A4	B1.3 B1.4	B2
12.12	<p>Hydraulic Power (ATA 29)</p> <p>System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Filters; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.</p>	1	3	-
12.13	<p>Ice and Rain Protection (ATA 30)</p> <p>Ice formation, classification and detection; Anti-icing and De-icing systems: electrical, hot air and chemical; Rain repellent and removal; Probe and drain heating; Wiper system.</p>	1	3	-
12.14	<p>Landing Gear (ATA 32)</p> <p>Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, tyres, brakes; Steering; Air-ground sensing; Skids, floats.</p>	2	3	-
12.15	<p>Lights (ATA 33)</p> <p>External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.</p>	2	3	-
12.16	<p>Pneumatic/Vacuum (ATA 36)</p> <p>System lay-out; Sources: engine, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.</p>	1	3	-

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A3 A4	B1.3 B1.4	B2
12.17	<p>Integrated Modular Avionics (ATA 42)</p> <p>Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others:</p> <p>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 and Brake Temperature Monitoring.</p> <p>Core System; Network Components.</p>	1	2	-
12.18	<p>On Board Maintenance Systems (ATA 45)</p> <p>Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring)</p>	1	2	-
12.19	<p>Information Systems (ATA 46)</p> <p>The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. Includes units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller. Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display.</p> <p>Typical examples include Air Traffic and Information Management Systems and Network Server Systems.</p> <p>Aircraft General Information System; Flight Deck Information System; Maintenance Information System; Passenger Cabin Information System; Miscellaneous Information System.</p>	1	2	-

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS

		Level		
		A	B1	B2
13.1	Theory of Flight			
	(a) Aeroplane Aerodynamics and Flight Controls	-	-	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.			
	(b) High Speed Flight	-	-	1
	Speed of sound, subsonic flight, transonic flight, supersonic flight;			
	Mach number, critical Mach number.			
	(c) Rotary Wing Aerodynamics	-	-	1
	Terminology;			
	Operation and effect of cyclic, collective and anti-torque controls.			
13.2	Structures – General Concepts			
	(a)	-	-	1
	Fundamentals of structural systems.			
	(b)	-	-	2
	Zonal and station identification systems;			
	Electrical bonding;			
	Lightning strike protection provision.			
13.3	Autoflight (ATA 22)	-	-	3
	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.			

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.4	<p>Communication/Navigation (ATA 23/34)</p> <p>Fundamentals of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter;</p> <p>Working principles of following systems:</p> <ul style="list-style-type: none"> - 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	<p>Electrical Power (ATA 24)</p> <p>Batteries Installation and Operation;</p> <p>DC power generation;</p> <p>AC power generation;</p> <p>Emergency power generation;</p> <p>Voltage regulation;</p> <p>Power distribution;</p> <p>Inverters, transformers, rectifiers;</p> <p>Circuit protection;</p> <p>External/Ground power.</p>	-	-	3
13.6	<p>Equipment and Furnishing (ATA 25)</p> <p>Electronic emergency equipment requirements;</p> <p>Cabin entertainment equipment.</p>	-	-	3

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.7	Flight Controls (ATA 27)			
	(a)	-	-	2
	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; Vibration measurement and indication; Glass cockpit.			

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.9	Lights (ATA 33) External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.	-	-	3
13.10	On board Maintenance Systems (ATA 45) Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).	-	-	3
13.11	Air Conditioning and Cabin Pressurisation (ATA 21)			
13.11.1	Air supply Sources of air supply including engine bleed, APU and ground cart;	-	-	2
13.11.2	Air Conditioning Air conditioning systems;	-	-	2
	Air cycle and vapour cycle machines;	-	-	3
	Distribution systems;	-	-	1
	Flow, temperature and humidity control system;	-	-	3
13.11.3	Pressurisation Pressurisation systems; Control and indication including control and safety valves; Cabin pressure controllers;	-	-	3
13.11.4	Safety and warning devices Protection and warning devices.	-	-	3
13.12	Fire Protection (ATA 26)			
	(a) Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.	-	-	3
	(b) Portable fire extinguisher	-	-	1

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.13	Fuel Systems (ATA 28)			
	System lay-out;	-	-	1
	Fuel tanks;	-	-	1
	Supply systems;	-	-	1
	Dumping, venting and draining;	-	-	1
	Cross-feed and transfer;	-	-	2
	Indications and warnings;	-	-	3
	Refuelling and defuelling;	-	-	2
	Longitudinal balance fuel systems.	-	-	3
13.14	Hydraulic Power (ATA 29)			
	System lay-out;	-	-	1
	Hydraulic fluids;	-	-	1
	Hydraulic reservoirs and accumulators;	-	-	1
	Pressure generation: electrical, mechanical, pneumatic;	-	-	3
	Emergency pressure generation;	-	-	3
	Filters;	-	-	1
	Pressure control;	-	-	3
	Power distribution;	-	-	1
	Indication and warning systems;	-	-	3
	Interface with other systems.	-	-	3
13.15	Ice and Rain Protection (ATA 30)			
	Ice formation, classification and detection;	-	-	2
	Anti-icing systems: electrical, hot air and chemical;	-	-	2
	De-icing systems: electrical, hot air, pneumatic, chemical;	-	-	3
	Rain repellent;	-	-	1
	Probe and drain heating;	-	-	3
	Wiper Systems.	-	-	1
13.16	Landing Gear (ATA 32)			
	Construction, shock absorbing;	-	-	1
	Extension and retraction systems: normal and emergency;	-	-	3
	Indications and warnings;	-	-	3
	Wheels, brakes, antiskid and autobraking;	-	-	3
	Tyres;	-	-	1
	Steering;	-	-	3
	Air-ground sensing.	-	-	3
13.17	Oxygen (ATA 35)			
	System lay-out: cockpit, cabin;	-	-	3
	Sources, storage, charging and distribution;	-	-	3
	Supply regulation;	-	-	3
	Indications and warnings.	-	-	3

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.18	Pneumatic/Vacuum (ATA 36) System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.	-	-	2
		-	-	2
		-	-	3
		-	-	1
		-	-	3
		-	-	3
13.19	Water/Waste (ATA 38) Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing.	-	-	2
13.20	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 and Brake Temperature Monitoring. Core System; Network Components.	-	-	3

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (Continued)

		Level		
		A	B1	B2
13.21	<p>Cabin Systems (ATA44)</p> <p>The units and components which furnish a means of entertaining the passengers and providing communication within the aircraft (Cabin Intercommunication Data System) and between the aircraft cabin and ground stations (Cabin Network Service). Includes voice, data, music and video transmissions.</p> <p>The Cabin Intercommunication Data System provides 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.</p> <p>The Cabin Network Service typically consists on a server, typically interfacing with, among others, the following systems: (a) Data/Radio Communication; and (b) In-Flight Entertainment System.</p> <p>The Cabin Network Service may host functions such as: (a) Access to pre-departure/departure reports; (b) E-mail/intranet/internet access; and (c) Passenger database.</p> <p>Cabin Core System; In-flight Entertainment System; External Communication System; Cabin Mass Memory System; Cabin Monitoring System; Miscellaneous Cabin System.</p>	-	-	3
13.22	<p>Information Systems (ATA46)</p> <p>The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. Includes units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller. Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display.</p> <p>Typical examples include:</p> <p>Air Traffic and Information Management Systems and Network Server Systems; Aircraft General Information System; Flight Deck Information System; Maintenance Information System; Passenger Cabin Information System; Miscellaneous Information System.</p>	-	-	3

MODULE 14. PROPULSION

		Level		
		A	B1	B2
14.1	Turbine Engines			
	(a) Constructional arrangement and operation of turbojet, turbofan, turboshaft and turbopropeller engines.	-	-	1
	(b) Electronic Engine control and fuel metering systems (FADEC).	-	-	2
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
14.3	Starting and Ignition Systems Operation of engine start systems and components; Ignition systems and components; Maintenance safety requirements.	-	-	2

MODULE 15. GAS TURBINE ENGINE

		Level		
		A1 A3	B1.1 B1.3	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 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.	1	2	-
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	-

MODULE 15. GAS TURBINE ENGINE (Continued)

		Level		
		A1 A3	B1.1 B1.3	B2
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 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.	1	2	-
15.15	Power Augmentation Systems Operation and applications; Water injection, water methanol; Afterburner systems.	-	1	-

MODULE 15. GAS TURBINE ENGINE (Continued)

		Level		
		A1 A3	B1.1 B1.3	B2
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		
		A2 A4	B1.2 B1.4	B2
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	-
16.2	Engine Performance Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.	1	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	-
16.4	Engine Fuel Systems			
16.4.1	Carburettors Types, construction and principles of operation; Icing and heating.	1	2	-
16.4.2	Fuel injection systems Types, construction and principles of operation.	1	2	-
16.4.3	Electronic engine control Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.	1	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	-
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	-

MODULE 16. PISTON ENGINE (Continued)

		Level		
		A2 A4	B1.2 B1.4	B2
16.7	Supercharging/Turbocharging Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/Turbocharging systems; System terminology; Control systems; System protection.	1	2	-
16.8	Lubricants and Fuels Properties and specifications; Fuel additives; Safety precautions.	1	2	-
16.9	Lubrication Systems System operation/lay-out and components.	1	2	-
16.10	Engine Indication Systems Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.	1	2	-
16.11	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	-
16.12	Engine Monitoring and Ground Operation 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.	1	3	-
16.13	Engine Storage and Preservation Preservation and depreservation for the engine and accessories/ systems.	-	2	-

MODULE 17. PROPELLER

		Level		
		A1 A2	B1.1 B1.2	B2
17.1	Fundamentals 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.	1	2	-
17.2	Propeller Construction Construction methods and materials used in wooden, 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.	1	2	-
17.3	Propeller Pitch Control Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Overspeed protection.	1	2	-
17.4	Propeller Synchronising Synchronising and synchrophasing equipment.	-	2	-
17.5	Propeller Ice Protection Fluid and electrical de-icing equipment.	1	2	-
17.6	Propeller Maintenance Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.	1	3	-
17.7	Propeller Storage and Preservation Propeller preservation and depreservation.	1	2	-