



**Bharat Institute of
Aeronautics**

Patna Airport, Patna - 800 014



SYLLABUS

CATEGORY B 1.1

BASE MAINTENANCE



Basic Maintenance Training Organisation Exposition
BHARAT INSTITUTE OF AERONAUTICS

SYLLABUS FOR CAT-B 1.1

TYPE OF TRAINING	LOCATION	ALLOTTED TIME (MINIMUM)
		Cat. B1
Knowledge Training	In-House	1440 Hours
Practical Training	In-House	670 Hours
	Sub-contracted	290 Hours
Total Hours		2400 Hours



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KNOWLEDGE TRAINING HOURS	
Mod. No.	Module Name
M.03	Electrical Fundamentals
M. 04	Electronic Fundamental
M.05	Digital Techniques/electronic Instrument Systems
M.06	Materials and Hardware
M.7a	Maintenance Practices
M.08	Basic Aerodynamics
M.9a	Human Factors
M.10	Aviation Legislation
M.11a	Turbine Aero plane Aerodynamics, Structures And Systems
M.15	Gas Turbine Engine
M.17a	Propeller



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MODULE 3. ELECTRICAL FUNDAMENTALS



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SYLLABUS PLAN

MODULE 3. ELECTRICAL FUNDAMENTALS

S. No.	Main Topic	Sub-Topic	LEVEL
3.1	Electron Theory	Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.	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	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.	2
3.4	Generation of Electricity	Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.	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;	2



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		Construction, materials and operation of thermocouples; Operation of photo-cells.	
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
3.7	Resistance/Resistor	(a) Resistance and affecting factors; Specific resistance; Resistor color 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
		(b) Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermostats, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.	1
3.8	Power	Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula;	2



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		Calculations involving power, work and energy.	
3.9	Capacitance/Capacitor	<p>Operation and function of a capacitor;</p> <p>Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating;</p> <p>Capacitor types, construction and function;</p> <p>Capacitor color coding;</p> <p>Calculations of capacitance and voltage in series and parallel circuits;</p> <p>Exponential charge and discharge of a capacitor, time constants;</p> <p>Testing of capacitors.</p>	2
3.10	Magnetism	<p>(a) Theory of magnetism;</p> <p>Properties of a magnet;</p> <p>Action of a magnet suspended in the Earth's magnetic field;</p> <p>Magnetization and demagnetization;</p> <p>Magnetic shielding;</p> <p>Various types of magnetic material;</p> <p>Electromagnets construction and principles of operation;</p> <p>Hand clasp rules to determine: magnetic field around current carrying conductor;</p>	2
		<p>(b) Magneto motive force, field strength, magnetic flux density, permeability, hysteresis loop, retentively, coercive force reluctance, saturation point, eddy currents;</p>	2



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		Precautions for care and storage of magnets.	
3.11	Inductance/Inductor	<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; Principle uses of inductors.</p>	2
3.12	DC Motor/Generator Theory	<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;</p>	2



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		Starter Generator construction.	
3.13	AC Theory	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.	2
3.14	Resistive (R), Capacitive (C) and Inductive (L) Circuits	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.	2
3.15	Transformers	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.	2
3.16	Filters	Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.	1



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3.17	AC Generators	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.	2
3.18	AC Motors	Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and poly phase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.	2



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**MODULE 4 :
ELECTRONIC
FUNDAMENTALS**



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MODULE 4. ELECTRONIC FUNDAMENTALS

S. No.	Main Topic	Sub-Topic	LEVEL
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
	4.1.2 Transistors	(a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.	1
	4.1.3 Integrated Circuits	(a) Description and operation of logic circuits and linear circuits/operational amplifiers;	1
4.2	Printed Circuit Boards	Description and use of printed circuit boards	1
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



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**MODULE 5.
DIGITAL
TECHNIQUES/ELECTRO
NIC INSTRUMENT
SYSTEM**



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MODULE 5. DIGITAL TECHNIQUES/ELECTRONIC INSTRUMENT SYSTEM

S. No.	Main Topic	Sub-Topic	LEVEL
5.1	Electronic Instrument Systems	Typical systems arrangements and cockpit layout of electronic instrument systems.	2
5.2	Numbering	Numbering systems: binary, octal and hexadecimal; Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.	1
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
5.4	Data Buses	Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications. Aircraft Network/Ethernet.	2
5.5	Logic Circuits	(a) Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic 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).	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;	1



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		Terminations; Couplers, control terminals, remote terminals; Application of fibre optics in aircraft systems.	
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
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.	2
5.13	Software Management Control	Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes.	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
5.15	Typical Electronic/Digital Aircraft Systems	General arrangement of typical electronic/digital aircraft systems and associated BITE (Built In Test Equipment) such as: (a) For B1 and B2 only: ACARS-ARINC Communication and Addressing and Reporting System EICAS-Engine Indication and Crew Alerting System FBW-Fly-by-Wire FMS-Flight Management System	2



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		IRS-Inertial Reference System; (b) For B1, B2 and B3: ECAM-Electronic Centralized Aircraft Monitoring EFIS-Electronic Flight Instrument System GPS-Global Positioning System TCAS-Traffic Alert Collision Avoidance System Integrated Modular Avionics Cabin Systems Information Systems.	
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MODULE 6. MATERIALS AND HARDWARE



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MODULE 6. MATERIALS AND HARDWARE

S. No.	Main Topic	Sub-Topic	LEVEL
6.1	Aircraft Materials-Ferrous	(a) Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels.	2
		(b) Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.	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;	2
		(b) Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact Resistance	1
6.3	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	2
		(b) The detection of defects/deterioration in composite and non-metallic material; Repair of composite and non-metallic material	2
	6.3.2 Wooden structures	Construction methods of wooden airframe structures; Characteristics, properties and types of wood and glue used in aero planes; 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.	2



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	6.3.3. Fabric covering	Characteristics, properties and types of fabrics used in aero planes; Inspections methods for fabric; Types of defects in fabric; Repair of fabric covering	2
6.4	Corrosion	(a) Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;	1
		(b) Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion	3
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
	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
	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
	6.5.4 Aircraft rivets	Types of solid and blind rivets: specifications and identification, heat treatment.	2
6.6	Pipes and Unions	(a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft	2
		(b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes	2
6.7	Springs	Types of springs, materials, characteristics and applications.	2
6.8	Bearings	Purpose of bearings, loads, material, construction; Types of bearings and their application.	2
6.9	Transmissions	Gear types and their application;	2



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		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	2
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



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MODULE 7A. MAINTENANCE PRACTICES



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MODULE 7A. MAINTENANCE PRACTICES

S. No.	Main Topic	Sub-Topic	LEVEL
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
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
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
7.4	Avionic General Test Equipment	Operation, function and use of avionic general test equipment.	2
7.5	Engineering Drawings, Diagrams and Standards	Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations;	2



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		<p>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>	
7.6	Fits and Clearances	<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>	2
7.7	Electrical Wiring Interconnection System (EWIS)	<p>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>	3
7.8	Riveting	<p>Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.</p>	2



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7.9	Pipes and Hoses	Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.	2
7.10	Springs	Inspection and testing of springs.	2
7.11	Bearings	Testing, cleaning and inspection of bearings; Lubrication requirements of bearings; Defects in bearings and their causes.	2
7.12	Transmissions	Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push-pull rod systems.	2
7.13	Control Cables	Swaging of end fittings; Inspection and testing of control cables; Bowden cables; aircraft flexible control systems.	2
7.14	Material handling		
	7.14.1 Sheet Metal	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
		(b) Welding and brazing methods; Inspection of welded and brazed joints; Bonding methods and inspection of bonded joints.	2



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7.16	Aircraft Weight and Balance	(a) Centre of Gravity/Balance limits calculation: use of relevant documents;	2
		(b) Preparation of aircraft for weighing; Aircraft weighing	2
7.17	Aircraft Handling and Storage	Aircraft taxiing/towing and associated safety precautions; Aircraft jacking, chocking, securing and associated safety precautions; Aircraft storage methods; Refueling/defueling procedures; De-icing/anti-icing procedures; Electrical, hydraulic and pneumatic ground supplies. Effects of environmental conditions on aircraft handling and operation.	2
7.18	Disassembly, Inspection, Repair and Assembly Techniques	(a) Types of defects and visual inspection techniques; Corrosion removal, assessment and reproduction	3
		(b) General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control program	2
		(c) Non-destructive inspection techniques including, penetrate, radiographic, eddy current, ultrasonic and baroscopic methods;	2
		(d) Disassembly and re-assembly techniques;	2
		(e) Trouble shooting techniques.	2
7.19	Abnormal Events	(a) Inspections following lightning strikes and HIRF penetration;	2
		(b) Inspections following abnormal events such as heavy landings and flight through turbulence.	2



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7.20	Maintenance Procedures	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.	2
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MODULE 8. BASIC AERODYNAMICS



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MODULE 8. BASIC AERODYNAMICS

S. No.	Main Topic	Sub-Topic	LEVEL
8.1	Physics of the Atmosphere	International Standard Atmosphere (ISA), application to aerodynamics	2
8.2	Aerodynamics	Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, up wash 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.	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.	2
8.4	Flight Stability and Dynamics	Longitudinal, lateral and directional stability (active and passive).	2



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MODULE 9A. HUMAN FACTOR



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MODULE 9A. HUMAN FACTOR

S. No.	Main Topic	Sub-Topic	LEVEL
9.1	General	The need to take human factors into account; Incidents attributable to human factors/human error; 'Murphy's' law.	2
9.2	Human Performance and Limitations	Vision; Hearing; Information processing; Attention and perception; Memory; Claustrophobia and physical access.	2
9.3	Social Psychology	Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.	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
9.5	Physical Environment	Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.	1
9.6	Tasks	Physical work;	1



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		Repetitive tasks; Visual inspection; Complex systems.	
9.7	Communication	Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.	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
9.9	Hazards in the Workplace	Recognizing and avoiding hazards; Dealing with emergencies.	2



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MODULE 10. AVIATION LEGISLATION



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MODULE 10. AVIATION LEGISLATION

S. No.	Main Topic	Sub-Topic	LEVEL
10.1	Regulatory Framework	Role of the International Civil Aviation Organisation; The Aircraft Act and Rules made there under Role of the DGCA; Relationship between CAR-21, CAR-M, CAR-145, CAR-66, CAR-147 The Aircraft Rules (Applicable to Aircraft Maintenance and release) Aeronautical Information and Circulars (Applicable to Aircraft Maintenance and release) CAR Sections 1 and 2	1
10.2	CAR-66 Certifying Staff- Maintenance	Detailed understanding of CAR-66.	2
10.3	CAR-145 Approved Maintenance Organisations	Detailed understanding of CAR-145 and CAR-M Subpart F.	2
10.4	Aircraft operations	Commercial Air Transport/Commercial Operations Air Operators Certificates; Operator's responsibilities, in particular regarding continuing airworthiness and maintenance; Documents to be carried on board; Aircraft placarding (markings).	1
10.5	Aircraft Certification	(a) General Certification Rules: such as FAA & EACS 23/25/27/29; Type Certification; Supplemental Type Certification;	1



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		CAR-21 Design/Production Organisation Approvals. Aircraft Modifications and Repairs Approval and certification Permit to fly requirements	
		(b) Documents Certificate of Airworthiness; Certificate of Registration; Noise Certificate; Weight Schedule; Radio Station License and Approval.	2
10.6	CAR-M	Detailed understanding of CAR-M provisions related to continuing airworthiness. Detailed understanding of CAR-M.	2
10.7	Applicable National and International Requirements	(a) Maintenance Programs, 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.	2
		(b) Continuing airworthiness; Test Flights; ETOPS/EDTO, maintenance and dispatch requirements; RVSM, maintenance and dispatch requirements; RNP, MNPS Operations All Weather Operations, Category 2/3 operations and minimum equipment requirements.	1



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10.8	Safety Management System	State safety program, Basic safety Concepts Hazards and safety Risks, SMS Operations SMS Safety Performance Safety Assurance	2
10.9	Fuel Tank Safety	Special Federal Aviation Regulations (SFARs) from 14 CFR SFAR 88 of the FAA and JAA TGL 47 Airworthiness Limitations Items (ALI)	2



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**MODULE 11A.
TURBINE AEROPLANE
AERODYNAMICS,
STRUCTURES AND
SYSTEMS**



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**MODULE 11A. TURBINE AEROPLANE AERODYNAMICS,
STRUCTURES AND SYSTEMS**

S. No.	Main Topic	Sub-Topic	LEVEL
11.1	Theory of Flight		
	11.1.1 Aero plane Aerodynamics and Flight Controls	Operation and effect of: — roll control: ailerons and spoilers, — pitch control: elevators, stabilities, variable incidence stabilizers 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.	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;	2



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		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
		(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, anodizing, painting; Surface cleaning; Airframe symmetry: methods of alignment and symmetry checks.	2



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11.3	Airframe Structures — Aero planes		
	11.3.1 Fuselage (ATA 52/53/56)	Construction and pressurization sealing; Wing, stabilizer, 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.	2
	11.3.2 Wings (ATA 57)	Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.	2
	11.3.3 Stabilizers (ATA 55)	Construction; Control surface attachment.	2
	11.3.4 Flight Control Surfaces (ATA 55/57)	Construction and attachment; Balancing — mass and aerodynamic.	2
	11.3.5 Nacelles/Pylons (ATA 54)	Nacelles/Pylons: — Construction, — Firewalls, — Engine mounts.	2
11.4	Air Conditioning and Cabin Pressurization (ATA 21)		
	11.4.1 Air supply	Sources of air supply including engine bleed, APU and ground cart.	2
	11.4.2 Air Conditioning	Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.	3



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	11.4.3 Pressurization	Pressurization systems; Control and indication including control and safety valves; Cabin pressure controllers.	3
	11.4.4 Safety and warning devices	Protection and warning devices.	3
	11.5 Instruments/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 coordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Glass cockpit; Other aircraft system indication.	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
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;	3



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		External/Ground power.	
11.7	Equipment and Furnishings (ATA 25)	(a) Emergency equipment requirements; Seats, harnesses and belts.	2
		(b) Cabin lay-out; Equipment lay-out; Cabin Furnishing installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Air stairs.	1
11.8	Fire Protection (ATA 26)	(a) Fire and smoke detection and warning systems; Fire extinguishing systems; System tests;	3
		(b) Portable fire extinguisher.	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/warning system.	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;	3



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		Refueling and defueling; Longitudinal balance fuel systems.	
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.	3
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; Probe and drain heating; Wiper systems. 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.	3
11.13	Landing Gear (ATA 32)	Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and auto braking; Tyres;	3



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		Steering; Air-ground sensing.	
11.14	Lights (ATA 33)	External: navigation, anti collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.	3
11.15	Oxygen (ATA 35)	System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.	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.	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.	3
11.18	On Board Maintenance Systems (ATA 45)	Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).	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	2



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		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. Core System; Network Components.	
11.20	Cabin Systems (ATA44)	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. 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.	2
11.21	Information Systems (ATA46)	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	2



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		<p>the information storage and retrieval function such as the electronic library mass storage and controller.</p> <p>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;</p> <p>Flight Deck Information System;</p> <p>Maintenance Information System;</p> <p>Passenger Cabin Information System;</p> <p>Miscellaneous Information System.</p>	



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MODULE 15. GAS TURBINE ENGINE



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SYLLABUS PLAN

MODULE 15. GAS TURBINE ENGINE

S. No.	Main Topic	Sub-Topic	LEVEL
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, turbo shaft, turboprop.	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
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	



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		stator blades; Compressor ratio.	
15.5	Combustion Section	Constructional features and principles of operation.	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
15.7	Exhaust	Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.	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.	2
15.10	Lubrication Systems	System operation/lay-out and components.	2
15.11	Fuel Systems	Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.	2
15.12	Air Systems	Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.	2
15.13	Starting and Ignition Systems	Operation of engine start systems and components; Ignition systems and components; Maintenance safety requirements.	2
15.14	Engine Indication Systems	Exhaust Gas Temperature/Inter stage Turbine Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems;	2



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		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; Over speed safety devices.	2
15.17	Turbo-shaft Engines	Arrangements drive systems, reduction gearing, couplings, control systems.	2
15.18	Auxiliary Power Units (APUs)	Purpose, operation, protective systems.	2
15.19	Power plant 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.	2
15.20	Fire Protection Systems	Operation of detection and extinguishing systems.	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 baroscopic) monitoring;	3



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		Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer; Compressor washing/cleaning; Foreign Object Damage.	
15.22	Engine Storage and Preservation	Preservation and de-preservation for the engine and accessories/systems	2



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MODULE 17A. PROPELLER



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SYLLABUS PLAN

MODULE 17A. PROPELLER

S. No.	Main Topic	Sub-Topic	LEVEL
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.	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.	2
17.3	Propeller Pitch Control	Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Over speed protection.	2
17.4	Propeller Synchronizing	Synchronizing and synchrophasing equipment.	2
17.5	Propeller Ice Protection	Fluid and electrical de-icing equipment.	2
17.6	Propeller Maintenance	Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, impact damage, delimitation; Propeller treatment/repair schemes; Propeller engine running.	3
17.7	Propeller Storage and Preservation	Propeller preservation and de-preservation.	2