COURSE MATERIAL

BASIC KNOWLEDGE THEORY SYLLABUS – FOR B1.2

MODULE 3 – ELECTRICAL FUNDAMENTALS		
S. No.	**Topics to be Covered**	
3.1	**ELECTRON THEORY**	
	a.	Structure and distribution of electrical charges within: atoms, molecules, ions, compounds;
	b.	Molecular structure of conductors, semiconductors and insulators.
3.2.	**STATIC ELECTRICITY AND CONDUCTION**	
	a.	Static electricity and distribution of electrostatic charges;
	b.	Electrostatic laws of attraction and repulsion;
	c.	Units of charge, Coulomb's Law;
	d.	Conduction of electricity in solids, liquids, gases and a vacuum.
3.3.	**ELECTRICAL TERMINOLOGY**	
	a.	The following terms, their units and factors affecting them: potential difference,electromotive force, voltage, current, resistance, conductance, charge, conventional current Flow, electron flow.
3.4.	**GENERATION OF ELECTRICITY**	
	a.	Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.
3.5.	**SOURCES OF DC ELECTRICITY**	
	a.	Construction and basic chemical action of: primary cells,
	b.	Secondary cells, lead acid cells, nickel cadmium cells, other
	c.	Alkaline cells;
	d.	Cells connected in series and parallel;
	e.	Internal resistance and its effect on a battery;
	f.	Construction, materials and operation of thermocouples;
	g.	Operation of photocells.
3.6.	**DC CIRCUITS**	
	a.	Ohms Law, Kirchhoff's Voltage and Current Laws;
	b.	Calculations using the above laws to find resistance, voltage and current;
	c.	Significance of the internal resistance of a supply
3.7.	**RESISTANCE/ RESISTOR**	
	a.	Resistance and affecting factors;
	b.	Specific resistance;
	c.	Resistor colour code, values and tolerances, preferred values, wattage ratings;
	d.	Resistors in series and parallel;

MODULE 3 – ELECTRICAL FUNDAMENTALS		
Sl. No.	**Topics to be Covered**	
3.7.1 Cont...	e.	Calculation of total resistance using series, parallel and series parallel combinations;
	f.	Operation and use of potentiometers and rheostats;
	g.	Operation of Wheatstone Bridge.
	h.	Positive and negative temperature coefficient conductance;
	i.	Fixed resistors, stability, tolerance and limitations, methods of construction;
	j.	Variable resistors, thermistors, voltage dependent resistors;
	k.	Construction of potentiometers and rheostats;
	l.	Construction of Wheatstone Bridge;
3.8.	**POWER**	
	a.	Power, work and energy (kinetic and potential);
	b.	Dissipation of power by a resistor;
	c.	Power formula;
	d.	Calculations involving power, work and energy.
3.9.	**CAPACITANCE/CAPACITOR**	
	a.	Operation and function of a capacitor;
	b.	Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric Constant, working voltage, voltage rating;
	c.	Capacitor types, construction and function;
	d.	Capacitor colour coding;
	e.	Calculations of capacitance and voltage in series and parallel circuits;
	f.	Exponential charge and discharge of a capacitor, time constants;
	g.	Testing of capacitors.
3.10.	**MAGNETISM**	
	a.	Theory of magnetism;
	b.	Properties of a magnet, Action of a magnet suspended in the Earth's magnetic field;
	c.	Magnetization and Demagnetization;
	d.	Magnetic shielding;
	e.	Various types of magnetic material;
	f.	Electromagnet’s construction and principles of operation;
	g.	Hand clasp rules to determine: magnetic field around current carrying conductor.
	h.	Magneto motive force, field strength, magnetic flux density, permeability, hysteresis loop, retentively, coercive force reluctance, saturation point, eddy currents;
	i.	Precautions for care and storage of magnets

MODULE 3 – ELECTRICAL FUNDAMENTALS		
Sl. No.	**Topics to be Covered**	
3.11.	**INDUCTANCE/ INDUCTOR**	
	a.	Faraday's Law;
	b.	Action of inducing a voltage in a conductor moving in a magnetic field;
	c.	Induction principles;
	d.	Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductors turns;
	e.	Mutual induction;
	f.	The effect the rate of change of primary current and mutual inductance has on induced voltage;
	g.	Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other;
	h.	Lenz's Law and polarity determining rules;
	i.	Back EMF, self-induction;
	j.	Saturation point;
	k.	Principle uses of inductors;
3.12.	**DC MOTOR/GENERATOR THEORY**	
	a.	Basic motor and generator theory;
	b.	Construction and purpose of components in DC generator
	c.	Operation of, and factors affecting output and direction of current flow in DC Generators
	d.	Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors;
	e.	Series wound, shunt wound and compound motors;
	f.	Starter Generator construction.
3.13.	**AC THEORY**	
	a.	Sinusoidal waveform: phase, period, frequency, cycle;
	b.	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;
	c.	Single/ 3 phase principles.
3.14.	**RESISTIVE (R), CAPACITIVE (C) AND INDUCTIVE (L) CIRCUIT**	
	a.	Phase relationship of voltage and current in L, C and R circuits, parallel, series and seriesparallel;
	b.	Power dissipation in L, C and R circuits;
	c.	Impedance, phase angle, power factor and current calculations;
	d.	True power, apparent power and reactive power calculations.
3.15.	**TRANSFORMERS**	
	a.	Transformer construction principles and operation;
	b.	Transformer losses and methods for overcoming them;

MODULE 3 – ELECTRICAL FUNDAMENTALS		
Sl. No.	**Topics to be Covered**	
	c.	Transformer action under load and no-load conditions;
	d.	Power transfer, efficiency, polarity markings;
	e.	Calculation of line and phase voltages and currents;
	f.	Calculation of power in a three-phase system;
	g.	Primary and Secondary current, voltage, turns ratio, power, efficiency;
	h.	Auto transformers.
3.16.	**FILTERS**	
	a.	Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.
3.17.	**AC GENERATORS**	
	a.	Rotation of loop in a magnetic field and waveform produced;
	b.	Operation and construction of revolving armature and revolving field type AC generators;
	c.	Single phase, two phase and three phase alternators;
	d.	Three phase star and delta connections advantage and uses;
	e.	Permanent Magnet Generators.
3.18	**AC MOTORS**	
	a.	Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphone;
	b.	Methods of speed control and direction of rotation;
	c.	Methods of producing a rotating field: capacitor, inductor, shaded or split Pole.

MODULE 4 – ELECTRONIC FUNDAMENTALS		
Sl. No.	**Topics to be Covered**	
4.1.	**SEMI CONDUCTORS**	
4.1.1.	**DIODES**	
	a.	Diode symbols, Diode characteristics and properties;
	b.	Diodes in series and parallel;
	c.	Main characteristics and use of silicon-controlled rectifiers (Thyristor), light emitting diode, photo conductive diode, varistor, rectifier diodes;
	d.	Functional testing of diodes.
	e.	Materials, electron configuration, electrical properties;
	f.	P and N type materials: effects of impurities on conduction, majority and minority characters;
	g.	PN junction in a semiconductor, development of a potential across a PN junction in unbiased,forward biased and reverse biased conditions;
	h.	Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers;
	i.	Detailed operation and characteristics of the following devices: silicon-controlled rectifier(thyristor), light emitting diode, Shottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode.
4.1.2.	**TRANSISTORS**	
	a.	Transistor symbols;
	b.	Component description and orientation;
	c.	Transistor characteristics and properties.
	d.	Construction and operation of PNP and NPN transistors;
	e.	Base, collector and emitter configurations;
	f.	Testing of transistors.
	g.	Basic appreciation of other transistor types and their uses.
	h.	Application of transistors: classes of amplifier (A, B, C);
	i.	Simple circuits including: bias, decoupling, feedback and stabilisation;
	j.	Multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.
4.1.3.	**INTEGRATED CIRCUITS**	
	a.	Description and operation of logic circuits and linear circuits/operational amplifiers.
	b.	Description and operation of logic circuits and linear circuits;
	c.	Introduction to operation and function of an operational amplifier used as: integrator,differentiator, voltage follower, comparator;
	d.	Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct;
	e.	Advantages and disadvantages of positive and negative feedback.

MODULE 4 – ELECTRONIC FUNDAMENTALS		
Sl. No.	**Topics to be Covered**	
4.2.	**PRINTED CIRCUIT BOARDS**	
	a.	Description and use of printed circuit boards.
4.3.	**SERVOMECHANISM**	
	a.	Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers;
	b.	Principles of operation and use of the following synchro system components/features:resolvers, differential, control and torque, transformers, inductance and capacitance transmitters.
	c.	Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, dead band;
	d.	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;
	e.	Servomechanism defects, reversal of synchro leads, hunting.

MODULE 5 – DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS		
Sl. No.	**Topics to be Covered**	
5.1.	**ELECTRONIC INSTRUMENT SYSTEMS**	
	a.	Typical systems arrangements and cockpit layout of electronic instrument systems.
5.2.	**NUMBERING SYSTEM**	
	a.	Numbering systems: binary, octal and hexadecimal;
	b.	Demonstration of conversions between the decimal and binary, octal and hexadecimal Systems and vice versa.
5.3.	**NUMBERING SYSTEM**	
	a.	Analogue Data, Digital Data;
	b.	Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types.
5.4.	**DATA BUSES**	
	a.	Identification of common logic gate symbols, tables and equivalent circuits;
	b.	Applications used for aircraft systems, schematic diagrams.
	c.	Interpretation of logic diagrams.
5.5.	**LOGIC CIRCUITS**	
	a.	Identification of common logic gate symbols, tables and equivalent circuits;
	b.	Applications used for aircraft systems, schematic diagrams.
	c.	Interpretation of logic diagrams.
5.6.	**BASIC COMPUTER STRUCTURE**	
	a.	Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memorydevices such as RAM, ROM, PROM);
	b.	Computer technology (as applied in aircraft systems)
	c.	Computer related terminology;
	d.	Operation, layout and interface of the major components in a microcomputer including their associated bus systems;
	e.	Information contained in single and multi-address instruction words;
	f.	Memory associated terms;
	g.	Operation of typical memory devices;
	h.	Operation, advantages and disadvantages of the various data storage systems
5.7.	**MICROPROCESSORS**	
	a.	Functions performed and overall operation of a microprocessor;
	b.	Basic operation of each of the following microprocessor elements: control and processingunit, clock, register, arithmetic logic unit.

MODULE 5 – DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS			
Sl. No.	**Topics to be Covered**		
5.8.	**INTEGRATED CIRCUITS**		
	a.	Operation and use of encoders and decoders	
	b.	Function of encoder types	
	c.	Uses of medium, large and very large-scale integration.	
5.9.	**MULTIPLEXING**		
	a.	Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.	
5.10.	**FIBRE OPTICS**		
	a.	Advantages and disadvantages of Fibre optic data transmission over electrical wire propagation;	
	b.	Fibre optic data bus;	
	c.	Fibre optic related terms;	
	d.	Terminations;	
	e.	Couplers, control terminals, remote terminals;	
	f.	Application of Fibre optics in aircraft systems.	
5.11.	**ELECTRONIC DISPLAYS**		
	a.	Principles of operation of common types of displays used in modern aircraft, including Cathode Ray Tubes, Light Emitting Diodes and Liquid Crystal Display.	
5.12.	**ELECTROSTATIC SENSITIVE DEVICES**		
	a.	Special handling of components sensitive to electrostatic discharges;	
	b.	Awareness of risks and possible damage, component and personnel anti-static protection devices.	
5.13.	**SOFTWARE MANAGEMENT CONTROL**		
	a.	Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes.	
5.14.	**ELECTROMAGNETIC ENVIRONMENT**		
	a.	Influence of the following phenomena on maintenance practices for electronic system:	
		i.	EMC-Electromagnetic Compatibility
		ii.	EMI-Electromagnetic Interference
		iii.	HIRF-High Intensity Radiated Field
		iv.	Lightning/ Lightning protection
5.15.	**TYPICAL ELECTRONIC/ DIGITAL AIRCRAFT SYSTEMS**		
	a.	General arrangement of typical electronic/digital aircraft systems and associated BITE (Built in Test Equipment) testing such as	
		i.	ACARS-ARINC Communication and Addressing and Reporting System
		ii.	EICAS-Engine Indication and Crew Alerting System
		iii.	FBW-Fly by Wire

MODULE 5 – DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS			
Sl. No.	**Topics to be Covered**		
	a.	iv.	FMS-Flight Management System
		v.	IRS-Inertial reference system
		vi.	ECAM-Electronic Centralised Aircraft Monitoring
		vii.	EFIS-Electronic Flight Instrument System
		viii.	GPS-Global Positioning System
		ix.	TCAS-Traffic Collision Avoidance system
		x.	Integrated modular Avionica
		xi.	Cabin System
		xii.	Information system

MODULE 6 – MATERIALS AND HARDWARE		
Sl. No.	**Topics to be Covered**	
6.1.	**AIRCRAFT MATERIALS – FERROUS**	
	a.	Characteristics, properties and identification of common alloy steels used in aircraft;
	b.	Heat treatment and application of alloy steels;
	c.	Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.
6.2.	**AIRCRAFT MATERIALS – NON-FERROUS**	
	a.	Characteristics, properties and identification of common non-ferrous materials used in aircraft;
	b.	Heat treatment and application of non-ferrous materials;
	c.	Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.
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;
	b.	Sealant and bonding agents.
	c.	The detection of defects/deterioration in composite and non-metallic material.
	d.	Repair of composite and non-metallic material.
6.3.2.	**WOODEN STRUCTURES**	
	a.	Construction methods of wooden airframe structures
	b.	Characteristics, properties and types of wood and glue used in Airplanes;
	c.	Preservation and maintenance of wooden structure;
	d.	Types of defects in wood material and wooden structures;
	e.	The detection of defects in wooden structure;
	f.	Repair of wooden structure.
6.3.3.	**FABRIC COVERING**	
	a.	Characteristics, properties and types of fabrics used in airplanes;
	b.	Inspections methods for fabric;
	c.	Types of defects in fabric; Repair of fabric covering.
6.4.	**CORROSION**	
	a.	Chemical fundamentals;
		Formation by, galvanic action process, microbiological, stress;
	b.	Types of corrosion and their identification;
		Causes of corrosion;
		Material types, susceptibility to corrosion.

MODULE 6 – MATERIALS AND HARDWARE		
Sl. No.	**Topics to be Covered**	
6.5.	**FASTENERS**	
6.5.1.	**SCREW THREADS**	
	a.	Screw nomenclature;
	b.	Thread forms, dimensions and tolerances for standard threads used in aircraft;
	c.	Measuring screw threads;
6.5.2.	**BOLTS, STUDS AND SCREWS**	
	a.	Bolt types: specification, identification and marking of aircraft bolts, international standards;
	b.	Nuts: self-locking, anchor, standard types;
	c.	Machine screws: aircraft specifications;
	d.	Studs: types and uses, insertion and removal;
	e.	Self-tapping screws, dowels.
6.5.3.	**LOCKING DEVICES**	
	a.	Tab and spring washers, locking plates, split pins, palnuts, wire locking, quick releasefasteners, keys, circlips, and cotter pins.
6.5.4.	**AIRCRAFT RIVETS**	
	a.	Types of solid and blind rivets: specifications and identification, heat treatment.
6.6.	**PIPES AND UNIONS**	
	a.	Identification of, and types of rigid and flexible pipes and their connectors used in aircraft;
	b.	Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.
6.7.	**SPRINGS**	
	a.	Types of springs, materials, characteristics and applications.
6.8.	**BEARINGS**	
	a.	Purpose of bearings, loads, material, construction;
	b.	Types of bearings and their application.
6.9.	**TRANSMISSIONS**	
	a.	Gear types and their application;
	b.	Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns;
	c.	Belts and pulleys, chains and sprockets.
6.10.	**CONTROL CABLES**	
	a.	Types of cables;
	b.	End fittings, turnbuckles and compensation devices;
	c.	Pulleys and cable system components;

MODULE 6 – MATERIALS AND HARDWARE		
Sl. No.	**Topics to be Covered**	
6.10. Cont…	d.	Bowden cables;
	e.	Aircraft flexible control systems.
6.11.	**ELECTRICAL CABLES AND CONNECTORS**	
	a.	Cable types, construction and characteristics;
	b.	High tension and co-axial cables;
	c.	Crimping;
	d.	Connector types, pins, plugs, sockets, insulators, current and voltage rating, coupling, identification codes.

MODULE 7A – MAINTENANCE PRACTICES		
Sl. No.	**Topics to be Covered**	
7.1.	**SAFETY PRECAUTIONS – AIRCRAFT AND WORKSHOP**	
	a.	Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals. Also, instruction in the remedialaction to be taken in the event of a fire or another accident with one or more of these hazards including knowledge on extinguishing agents.
7.2.	**WORKSHOP PRACTICES**	
	a.	Care of tools, control of tools, use of workshop materials;
	b.	Dimensions, allowances and tolerances, standards of workmanship;
	c.	Calibration of tools and equipment, calibration standards.
7.3.	**TOOLS**	
	a.	Common hand tool types;
	b.	Common power tool types;
	c.	Operation and use of precision measuring tools;
	d.	Lubrication equipment and methods.
	e.	Operation, function and use of electrical general test equipment;
7.4.	**RESERVED**	
7.5.	**ENGINEERING DRAWINGS, DIAGRAMS AND STANDARDS**	
	a.	Drawing types and diagrams, their symbols, dimensions, tolerances and projections;
	b.	Identifying title block information Microfilm, microfiche and computerized presentations;
	c.	Specification 100 of the Air Transport Association (ATA) of America;
	d.	Aeronautical and other applicable standards including ISO, AN, MS, NAS and MIL;
	e.	Wiring diagrams and schematic diagrams.
7.6.	**FITS AND CLEARANCES**	
	a.	Drill sizes for bolt holes, classes of fits;
	b.	Common system of fits and clearances;
	c.	Schedule of fits and clearances for aircraft and engines;
	d.	Limits for bow, twist and wear;
	e.	Standard methods for checking shafts, bearings and other parts.
7.7.	**ELECTRICAL WIRING INTERCONNECTION SYSTEM (EWIS)**	
	a.	Continuity, insulation and bonding techniques and testing;
	b.	Use of crimp tools: hand and hydraulic operated;
	c.	Testing of crimp joints;
	d.	Connector pin removal and insertion;

MODULE 7A – MAINTENANCE PRACTICES		
Sl. No.	**Topics to be Covered**	
7.7.	e.	Co-axial cables: testing and installation precautions;
	f.	Identification of wire types, their inspection criteria and damage tolerance.
	g.	Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.
	h.	EWIS installations, inspection, repair, maintenance and cleanliness standards.
7.8.	**RIVETING**	
	a.	Riveted joints, rivet spacing and pitch;
	b.	Tools used for riveting and dimpling;
	c.	Inspection of riveted joints.
7.9.	**PIPES AND BEARINGS**	
	a.	Bending and belling/flaring aircraft pipes;
	b.	Inspection and testing of aircraft pipes and hoses;
	c.	Installation and clamping of pipes.
7.10.	**SPRINGS**	
	a.	Inspection and testing of springs.
7.11.	**BEARINGS**	
	a.	Testing, cleaning and inspection of bearings;
	b.	Lubrication requirements of bearings;
	c.	Defects in bearings and their causes.
7.12.	**TRANSMISSIONS**	
	a.	Inspection of gears, backlash;
	b.	Inspection of belts and pulleys, chains and sprockets;
	c.	Inspection of screw jacks, lever devices, push-pull rod systems.
7.13.	**CONTROL CABLES**	
	a.	Swaging of end fittings;
	b.	Inspection and testing of control cables;
	c.	Bowden cables; aircraft flexible control systems.
7.14.	**MATERIAL HANDLING** **SHEET METAL**	
	a.	Marking out and calculation of bend allowance;
	b.	Sheet metal working, including bending and forming;
	c.	Inspection of sheet metal work.

MODULE 7A – MAINTENANCE PRACTICES		
Sl. No.	**Topics to be Covered**	
7.14.2.	**COMPOSITE AND NON-METALLIC**	
	a.	Bonding practices;
	b.	Environmental conditions
	c.	Inspection methods
7.15.	**RESERVED**	
7.16.	**AIRCRAFT WEIGHT AND BALANCE**	
	a.	Centre of Gravity/Balance limits calculation: use of relevant documents;
	b.	Preparation of aircraft for weighing; Aircraft weighing;
7.17.	**AIRCRAFT HANDLING AND STORAGE**	
	a.	Aircraft taxiing/towing and associated safety precautions;
	b.	Aircraft jacking, chocking, securing and associated safety precautions;
	c.	Aircraft storage methods;
	d.	Refuelling/ defueling procedures;
	e.	De-icing/ anti-icing procedures;
	f.	Electrical, hydraulic and pneumatic ground supplies.
	g.	Effects of environmental conditions on aircraft handling and operation.
7.18.	**DISASSEMBLY, INSPECTION, REPAIR AND ASSEMBLY TECHNIQUES**	
	a.	Types of defects and visual inspection techniques. Corrosion removal, assessment and re-protection.
	b.	General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes;
	c.	Non-destructive inspection techniques including, penetrant, radiographic, Eddy current, ultrasonic and Boroscope methods.
	d.	Disassembly and re-assembly techniques.
	e.	Trouble shooting techniques

MODULE 7A – MAINTENANCE PRACTICES		
Sl. No.	**Topics to be Covered**	
7.19.	**ABNORMAL EVENTS**	
	a.	Inspections following lightning strikes and HIRF penetration.
	b.	Inspections following abnormal events such as heavy landings and flight through turbulence.
7.20.	**MAINTENANCE PROCEDURES**	
	a.	Maintenance planning;
	b.	Modification procedures;
	c.	Store's procedures;
	d.	Certification/release procedures;
	e.	Interface with aircraft operation;
	f.	Maintenance Inspection/Quality Control/Quality Assurance;
	g.	Additional maintenance procedures. Control of life limited components

MODULE 8 – BASIC AERODYNAMICS		
Sl. No.	**Topics to be Covered**	
8.1.	**PHYSICS OF THE ATMOSPHERE**	
	a.	International Standard Atmosphere (ISA), application to aerodynamics.
8.2.	**AERODYNAMICS**	
	a.	Airflow around a body;
	b.	Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, up wash and downwash, vortices, stagnation
	c.	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 andaspect ratio;
	d.	Thrust, Weight, Aerodynamic Resultant;
	e.	Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall;
	f.	Aerofoil contamination including ice, snow, frost.
8.3.	**THEORY OF FLIGHT**	
	a.	Relationship between lift, weight, thrust and drag;
	b.	Glide ratio;
	c.	Steady state flights, performance;
	d.	Theory of the turn;
	e.	Influence of load factor: stall, flight envelope and structural limitations;
	f.	Lift augmentation.
8.4.	**FLIGHT STABILITY AND DYNAMICS**	
	a.	Longitudinal, lateral and directional stability (active and passive).

MODULE 9 – HUMAN FACTOR		
Sl. No.	**Topics to be Covered**	
9.1.	**GENERAL**	
	a.	The need to take human factors into account;
	b.	Incidents attributable to human factors/human error;
	c.	'Murphy's' law.
9.2.	**HUMAN PERFORMANCE AND LIMITATIONS**	
	a.	Vision;
	b.	Hearing;
	c.	Information processing;
	d.	Attention and perception;
	e.	Memory;
	f.	Claustrophobia and physical access.
9.3.	**SOCIAL PSYCHOLOGY**	
	a.	Responsibility: individual and group;
	b.	Motivation and de-motivation;
	c.	Peer pressure;
	d.	'Culture' issues;
	e.	Team working;
	f.	Management, supervision and leadership
9.4.	**FACTORS AFFECTING PERFORMANCE**	
	a.	Fitness/health;
	b.	Stress: domestic and work related;
	c.	Time pressure and deadlines;
	d.	Workload: overload and underload;
	e.	Sleep and fatigue, shift work;
	f.	Alcohol, medication, drug abuse.
9.5.	**PHYSICAL ENVIRONMENT**	
	a.	Noise and fumes;
	b.	Illumination;
	c.	Climate and temperature;
	d.	Motion and vibration;
	e.	Working environment.

MODULE 9 – HUMAN FACTOR		
Sl. No.	**Topics to be Covered**	
9.6.	**TASKS**	
	a.	Physical work;
	b.	Repetitive tasks;
	c.	Visual inspection;
	d.	Complex systems.
9.7.	**COMMUNICATION**	
	a.	Within and between teams;
	b.	Work logging and recording;
	c.	Keeping up to date, currency;
	d.	Dissemination of information.
9.8.	**HUMAN ERROR**	
	a.	Error models and theories;
	b.	Types of error in maintenance tasks;
	c.	Implications of errors (i.e., accidents)
	d.	Avoiding and managing errors.
9.9.	**SAFETY**	
	a.	Recognizing and avoiding hazards;
	b.	Dealing with emergencies.

MODULE 10 – AVIATION LEGISLATION		
Sl. No.	**Topics to be Covered**	
10.1.	**REGULATORY FRAMEWORK**	
	a.	Role of International Civil Aviation Organization (ICAO);
	b.	Directorate General of Civil Aviation (DGCA), India;
	c.	The Aircraft Act and Rules made thereunder relating to airworthiness
	d.	CAR-21, CAR-M, CAR-145, CAR-66, CAR 147, CAR ML, CAR- CAMO, CAR-CAO
	e.	The relationship between regulations and AMC, GM, AAC etc.
	f.	occurrence reporting according to CAR Section 2 Series C Part I, CAR M, CAR ML, CAR-145 and CAR-CAO;
	g.	Aeronautical Information Circulars (Applicable to Aircraft Maintenance and Release)
	h.	the relationship between Initial and Continuing Airworthiness (such as CAR 21, CAR M, CAR-145, CAR-66, CAR-147, CAR-ML, CAR-CAMO, and CAR-CAO) and regulations related to the Air Operations and regulation related to the Air Crew
10.2.	**CAR-66 CERTIFYING STAFF – MAINTENANCE**	
	a.	Detailed understanding of CAR-66.
10.3.	**CAR-145 — APPROVED MAINTENANCE ORGANIZATIONS**	
	a.	Detailed understanding of CAR-145 and CAR M Subpart F
10.4.	**INDEPENDENT CERTIFYING STAFF**	
	a.	Privileges, responsibilities, record-keeping, limitations, and oversight according to CAR-M, CAR -66 and CAR -ML.
10.5.	**AIR OPERATIONS**	
	a.	General understanding of regulation relating to air operations
	b.	Differences between commercial and non-commercial air operations, and their influence on aircraft maintenance
	c.	Air Operator Certificates (AOCs)/ Air Operator Permits (AOP) Air operator responsibilities, in particular regarding continuing airworthiness and maintenance
	d.	Specialised operations / specific approvals: ETOPS, CAT I/II/III, and BRNAV. Minimum Equipment List (MEL) and Configuration Deviation List (CDL);
	e.	Aircraft placarding and markings;
	f.	Documents to be carried on board
		Certificate of Airworthiness / Restricted Certificate of Airworthiness
		Airworthiness Review Certificate;
		Permit to Fly;
		Certificate of Registration;
		Noise Certificate; Weight and Balance report; Radio Station Licence

MODULE 10 – AVIATION LEGISLATION		
Sl. No.	**Topics to be Covered**	
10.6.	**CERTIFICATION OF AIRCRAFT, PARTS, AND APPLIANCES**	
	a.	Basic understanding of CAR 21
10.7.	**CONTINUING AIRWORTHINESS**	
	a.	General understanding of the CAR 21 requirements on continuing airworthiness;
	b.	General understanding of CAR-M, CAR-ML and CAR-CAMO;
	c.	Aircraft Maintenance Programme.
10.8.	**OVERSIGHT PRINCIPLES IN CONTINUING AIRWORTHINESS**	
10.9.	**RESERVED**	
10.10	**CYBER SECURITY IN AVIATION MAINTENANCE**	
	Regulation on the introduction of organisation requirements for the management of information security risks related to aeronautical information systems used in civil aviation.	

MODULE 11A – TURBINE AEROPLANE AERODYNAMICS, STRUCTURE AND SYSTEMS		
Sl. No.	**Topics to be Covered**	
11.1.	**THEORY OF FLIGHT**	
	a.	Aeroplane aerodynamics and flight controls Operation and effect of
		roll control: ailerons and spoilers
		pitch control: elevators, stabilators, variable incidence stabilisers and canards;
		yaw control, rudder limiters; elevons,
		Ruddervators
		high-lift devices, slots, slats, flaps, flaperons;
		drag-inducing devices, spoilers, lift dumpers, speed brakes
		Trim tabs, servo tabs, control surface bias.
	b.	Aeroplane: other aerodynamic devices Operation and effect of
		Balance and antibalance (leading) tabs
		Spring tabs, mass balance, aerodynamic balance
		Panels; mass balance, aerodynamic balance panels
		Effects of wing fences, saw tooth leading edges
		Boundary layer control using vortex generators, stall wedges or leading-edge devices
11.1.2.	**HIGH SPEED FLIGHT**	
	a.	Speed of sound, subsonic flight, transonic flight, supersonic flight,
	b.	Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule;
	c.	Factors affecting airflow in engine intakes of high-speed aircraft;
	d.	Effects of sweepback on critical Mach number.
11.2.	**AIRFRAME STRUCTURES (ATA 51)**	
	a.	General concepts:
		Zonal and station identification systems
		Electrical bonding
		Lightning strike protection provisions.
	b.	Airworthiness requirements for structural strength:
		Structural classification: primary, secondary, and tertiary; Fail-safe, safe-life, damage-tolerance , concepts
		Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue
		Drains and ventilation provisions
		System installation provisions.

MODULE 11A – TURBINE AEROPLANE AERODYNAMICS, STRUCTURE AND SYSTEMS		
	Topics to be Covered	
	c.	Construction methods
		Stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, skinning, anticorrosive protection, wing, empennage and engine attachments
		Structure assembly techniques: riveting, bolting
		bonding; Methods of surface protection, such as chromating, anodising, painting
		Surface cleaning; Airframe symmetry: methods of alignment and symmetry checks.
11.3.	**AIRFRAME STRUCTURES — AEROPLANES**	
11.3.1.	**FUSELAGE, WINDOWS, DOORS (ATA 52/ 53/ 56)**	
	a.	Construction principles
		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.
	b.	Airborne towing devices (glider, banner, target)
	c	Doors
		Doors and emergency exits: safety devices
		Cargo loading system.
11.3.2.	**WINGS (ATA 57)**	
	a.	Construction;
	b.	Fuel storage;
	c.	Landing gear, pylon, control surface and high lift/drag attachments.
11.3.3.	**STABILIZERS (ATA 55)**	
	a.	Construction;
	b.	Control surface attachment.
11.3.4.	**FLIGHT CONTROL SURFACES (ATA 55/ 57)**	
	a.	Construction and attachment;
	b.	Balancing mass and aerodynamic.
11.3.5.	**NACELLES/ PYLONS (ATA 54)**	
		Nacelles/Pylons
		Construction, Firewalls, Engine mounts

11.4.	**AIR CONDITIONING AND CABIN PRESSURISATION (ATA 21)**	
	a.	Pressurisation Pressurisation systems; Cabin pressure controllers, control, and safety valves; Control and indication.
	b.	Air supply Sources of air supply including engine bleed, APU and ground cart; Distribution systems.
	c.	Air conditioning Air-conditioning systems; Air cycle and vapour cycle machines; Flow, temperature and humidity control system; Control and indication control valves.
	d.	Safety and warning devices Protection and warning devices.
	e.	Heating and ventilation systems.

MODULE 11A – TURBINE AEROPLANE AERODYNAMICS, STRUCTURE AND SYSTEMS		
Sl. No.		**Topics to be Covered**
11.5	**Instruments / avionics systems**	
11.5.1	**INSTRUMENT SYSTEMS (ATA 31)**	
		Pitot-static: Airspeed indicators, Vertical speed indicators, Altimeters
		Gyroscopic: Gyroscopic principles, Artificial horizons, Attitude directors, Direction indicators, Horizontal situation indicators (HSI), Slip indicators, Turn indicators, Turn coordinators
		Compass systems: systems, direct reading, remote reading, Stall-warning systems and angle-of-attack indicating systems, Glass cockpit
		Indications of other aircraft systems
11.5.2	**AVIONICS SYSTEMS**	
	a.	Fundamentals of system layouts and operation of: Auto flight (ATA 22); Communication systems (ATA 23)
		Very High Frequency (VHF) communications, High Frequency (HF) communications, Satellite Communications (SATCOM), Controller pilot data link communications (CPDLC), Audio systems
		Emergency Locator Transmitters (ELTs)
		Cockpit Voice Recorder (CVR)
	b.	Navigation systems (ATA 34)
		Very high frequency omnidirectional range (VOR), Automatic direction finder (ADF), Instrument landing system (ILS), Microwave landing system (MLS),
		Flight director systems (FDSs), distance-measuring equipment (DME), Area navigation (RNAV) systems, Flight management systems (FMSs), Satellite navigation systems
		Air traffic control transponder, secondary surveillance radar, Traffic alert and collision avoidance system (TCAS), Weather avoidance radar
		Radio altimeter, Inertial navigation system (INS),
		ARINC (Aeronautical Radio Incorporated) communication and reporting.
		Types and uses of avionics general test equipment
11.6	**ELECTRICAL POWER (ATA 24)**	
	a.	Installation and operation of batteries
	b.	DC power generation; AC power generation; Emergency power generation
	c.	Voltage regulation; Power distribution; Inverters, transformers, rectifiers
	d.	Circuit protection; External/ground power.

11.7.	**EQUIPMENT AND FURNISHINGS (ATA 25)**	
	a.	Emergency equipment: Emergency equipment requirements
	b.	Cabin and cargo layout
		Seats, harnesses, and belts
		Cabin layout, Equipment layout
		Cabin furnishing installation, Galley installation
		Cargo handling and retention equipment, Airstairs.
11.8	**Fire protection (ATA 26)**	
	a.	Fire and smoke detection system, and fire extinguishing systems
		Fire and smoke detection and warning systems
		Fire-extinguishing systems, System tests.
	b.	Portable fire extinguisher.
11.9	**Flight controls (ATA 27)**	
	a.	Primary and secondary flight controls:
		Primary controls: aileron, elevator, rudder, spoiler
		Trim control, trim tabs, High-lift devices
		System operation: manual
		Gust locks and gust lock systems
		Artificial feel, yaw damper, Mach trim, rudder limiter, Stall-warning systems.
	b.	Actuation and
		Protection: Active load control
		Lift dump, speed brakes, Hydraulic, pneumatic
		Systems, Stall-protection systems.
	c.	System operation, Electrical systems, fly-by-wire systems.
	d.	Balancing and rigging.
11.10	**Fuel systems (ATA 28, ATA 47)**	
	a.	Systems:
		System layout
		Fuel tanks
		Supply systems.
	b.	Fuel handling:
		Cross-feed and transfer, Refuelling and defuelling.
	c.	Indication and warnings.
	d.	Special systems:

		Dumping, venting, and draining; Inert gas systems.
	e.	Balancing: Longitudinal balance fuel systems.
11.11.	**Hydraulic power (ATA 29)**	
	a.	System description:
		System layout, Hydraulic fluids, Hydraulic reservoirs and accumulators, Filters, Power distribution.
	b.	System operation (1):
		Pressure generation:
		Electric and mechanical, Pressure control, Indication and warning systems, Servicing.
	c.	System operation (2):
		Pressure generation:
		Pneumatic, Emergency pressure generation, Interface with other systems.
11.12.	**Ice and rain protection (ATA 30)**	
	a.	Principles:
		Ice formation, classification, and detection.
	b.	De-icing:
		De-icing systems: electrical, hot-air, pneumatic, chemical; Probe and drain heating.
	c.	Anti-icing:
		Anti-icing systems: electrical, hot-air, chemical.
	d.	Wipers:
		Wiper systems.
	e.	Rain-repellent systems.
11.13.	**Landing gear (ATA 32)**	
	a.	Description: Construction, shock absorbing; Tyres.
	b.	Systems: Extension and retraction systems: normal and emergency; Indications and warnings; Wheels, brakes, antiskid, and auto braking; Steering
	c.	Air ground sensing
	d.	Tail protection: Skids
11.14	**LIGHTS (ATA 33)**	
	a.	External: navigation, anticollision, landing, taxiing, ice;
	b.	Internal: cabin, cockpit, cargo; Emergency.
11.15	**OXYGEN (ATA 35)**	
		System layout: cockpit, cabin
		Sources, storage, charging and distribution; Supply regulation
		Indications and warnings.
11.16	**PNEUMATIC / VACUUM (ATA 36)**	
	a.	Systems: System layout
		Sources: engine / APU (Auxiliary Power Unit), compressors, reservoirs, ground supply; Pressure control; Distribution

MODULE 11A – TURBINE AEROPLANE AERODYNAMICS, STRUCTURE AND SYSTEMS		
Sl. No.	**Topics to be Covered**	
	b.	Pumps: Pressure and vacuum pumps.
11.17	**WATER / WASTE (ATA 38)**	
	a.	Systems:
		Water system layout, supply, distribution, servicing and draining; Toilet system layout, flushing and servicing.
	b.	Corrosion: Corrosion aspects.
11.18	**ONBOARD MAINTENANCE SYSTEMS (ATA 45)**	
	a.	Central maintenance computers; Data-loading system
		Electronic library system; Printing systems
		Structure monitoring (damage-tolerance monitoring).
		Bleed management, air pressure control, air ventilation and control, avionics and cockpit ventilation control, temperature control, air traffic communication, avionics communication router
		electrical load management, circuit breaker monitoring, electrical system BITE, fuel management, braking control, steering control, landing gear extension and retraction, tyre pressure indication, oleo pressure indication, brake temperature monitoring, etc.
	b.	Typical system layout.
11.20.	**CABIN SYSTEMS (ATA 44)**	
	a.	System architecture, operation, and control of systems for
		passenger in-flight entertainment; communication within the aircraft (Cabin intercommunication data system (CIDS); communication between the aircraft cabin and ground stations
		Including voice, data, music, and video transmission. CIDS interface between cockpit/cabin crew and cabin systems. Data exchange between the different related line replaceable units (LRUs). Flight attendant panels (FAPs).
	b.	Cabin network server (CNS) and interfaces with the following systems
		Data/radio communication
		Cabin core system (CCS)
		In-flight entertainment system (IFES)
		External communication system (ECS)
		Cabin mass memory system (CMMS)
		Cabin monitoring system (CMS)
		Miscellaneous cabin systems (MCSs) and Other systems.
	c.	Cabin network server (CNS) hosting functions
		Access to predeparture/departure reports

		Email/intranet/internet access; passenger database
		External communication system
		Cabin mass memory system, Cabin monitoring system, Miscellaneous cabin system.
11.21.	**INFORMATION SYSTEMS (ATA 46)**	
	a.	System architecture, operation, and control of
		Storage and electronic library, Updating;
		Retrieving of digital information
		Air traffic and information management systems (ATIMS) and network server systems
		Aircraft general information system
		Flight deck information system
		Maintenance information system
		Passenger cabin information system
		Miscellaneous information systems ,Other linked systems.

MODULE 16 – PISTON ENGINE		
Sl. No.	**Topics to be Covered**	
16.1.	**FUNDAMENTALS**	
	a.	Mechanical, thermal, and volumetric efficiencies
	b.	Operating principles: 2-stroke, 4-stroke, Otto, diesel, and rotary (Wankel)
	c.	Piston displacement and compression ratio
	d.	Engine configuration and firing order.
16.2.	**ENGINE PERFORMANCE**	
	a.	Power calculation and measurement
	b.	Factors that affect engine power
	c.	Mixtures/leaning, pre-ignition.
16.3.	**ENGINE CONSTRUCTION**	
	a.	Crank case, crank shaft, cam shafts, sumps
	b.	Accessory gearbox; Cylinder and piston assemblies
	c.	Connecting rods, inlet and exhaust manifolds;.
	d.	Valve mechanisms
	e.	Propeller reduction gearboxes.
16.4.	**ENGINE FUEL SYSTEMS**	
16.4.1	**CARBURETTORS**	
	a.	Types, construction, and principles of operation
	b.	Icing and heating.
16.4.2	**FUEL INJECTION SYSTEMS**	
	a.	Types, construction, and principles of operation.
16.4.3	**ELECTRONIC ENGINE CONTROL**	
	a.	Operation of engine control and fuel-metering systems including electronic engine control (full authority digital engine control (FADEC)
	b.	System layout and components.

MODULE 16 – PISTON ENGINE		
Sl. No.	**Topics to be Covered**	
16.5	**STARTING AND IGNITION SYSTEMS**	
	a.	Starting systems, preheat systems
	b.	Magneto types, construction, and principles of operation
	c.	Ignition harnesses, spark plugs
	d.	Low- and high-tension systems.
16.6.	**INDUCTION, EXHAUST, AND COOLING SYSTEMS**	
	a.	Construction and operation of induction systems, including alternate air systems
	b.	Exhaust systems, engine cooling systems air and liquid.
16.7.	**SUPERCHARGING/TURBOCHARGING**	
	a.	Principles and purpose of supercharging and its effects on engine parameters
	b.	Construction and operation of supercharging/turbocharging systems
	c.	System terminology
	d.	Control systems
	e.	System protection
16.8.	**LUBRICANTS AND FUELS**	
	a.	Properties and specifications of standard, alternate, and drop-in fuel
	b.	Properties and specifications of lubricants
	c.	Fuel additives
	d.	Safety precautions.
16.9.	**LUBRICATION SYSTEMS**	
	a.	System operation/layout and components.
16.10.	**ENGINE INDICATION SYSTEMS**	
	a.	Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature.
	b.	Exhaust gas temperature; Fuel pressure and flow; Manifold pressure.
16.11.	**POWER PLANT INSTALLATION**	
	a.	Configuration of firewalls, cowlings, acoustic panels, engine mounts, antivibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.
16.12.	**ENGINE MONITORING AND GROUND OPERATION**	
	a.	Procedures for starting and ground run-up
	b.	Interpretation of engine power output and parameters
	c.	Inspection of engine and components: criteria, tolerances, and data specified by the engine manufacturer.

MODULE 15 – GAS TURBINE ENGINE		
Sl. No.	**Topics to be Covered**	
16.13.	**ENGINE STORAGE AND PRESERVATION**	
	a.	Preservation and depreservation for the engine and its accessories/systems.
16.14.	**ALTERNATE PISTON-ENGINE CONSTRUCTIONS**	
	a.	Hybrid piston electric concepts and electric power augmentation.

MODULE 17 – PROPELLER		
Sl. No.	**Topics to be Covered**	
17.1.	**FUNDAMENTALS**	
	a.	Blade element theory;
	b.	High/low blade angle, reverse angle, angle of attack, rotational speed;
	c.	Propeller slip;
	d.	Aerodynamic, centrifugal, and thrust forces;
	e.	Torque;
	f.	Relative airflow on blade angle of attack;
	g.	Vibration and resonance.
17.2.	**PROPELLER CONSTRUCTION**	
	a.	Construction methods and materials used in wooden, composite and metal propellers
	b.	Blade station, blade face, blade shank, blade back / thrust face and hub assembly
	c.	Fixed pitch, controllable pitch, constant speeding propeller
	d.	Propeller/spinner installation.
17.3.	**PROPELLER PITCH CONTROL**	
	a.	Speed control and pitch change methods, mechanical and electrical/electronic;
	b.	Feathering and reverse pitch;
	c.	Overspeed protection.
17.4.	**PROPELLER SYNCHRONIZING**	
	a.	Synchronizing and synchrophasing equipment.
17.5.	**PROPELLER ICE PROTECTION**	
	a.	Fluid and electrical de-icing equipment.
17.6.	**PROPELLER MAINTENANCE**	
	a.	Static and dynamic balancing;
	b.	Blade tracking;
	c.	Assessment of blade damage, erosion, corrosion, impact damage, delamination;
	d.	Propeller treatment/repair schemes;
	e.	Propeller engine running.
17.7.	**PROPELLER STORAGE AND PRESERVATION**	
	a.	Propeller preservation and de-preservation

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