COURSE MATERIAL

BASIC KNOWLEDGE THEORY SYLLABUS – FOR B2

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.	**DC SOURCES OF 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**		
5.15. Cont…	a. Cont..	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;
	b.	Formation by, galvanic action process, microbiological, stress;
	c.	Types of corrosion and their identification;
	d.	Causes of corrosion;
	e.	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 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.
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.	**AVIONIC GENERAL TEST EQUIPMENT**	
	a.	Operation, function and use of avionic general test equipment.
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. Cont …	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.

7.15.	**WELDING, BRAZING, SOLDERING AND BONDING**	
	a.	Soldering methods; inspection of soldered joints.
	b.	Welding and brazing methods;
	c.	Inspection of welded and brazed joints;
	d.	Bonding methods and inspection of bonded joints.
7.16.	**AIRCRAFT WEIGHT AND BALANCE**	
	a.	Centre of Gravity/Balance limits calculation: use of relevant documents;
	b.	Preparation of aircraft for weighing;
	c.	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.
	b.	Corrosion removal, assessment and re-protection.
	c.	General repair methods, Structural Repair Manual;
	d.	Ageing, fatigue and corrosion control programmes;
	e.	Non-destructive inspection techniques including, penetrant, radiographic, Eddy current, ultrasonic and Boroscope methods.
	f.	Disassembly and re-assembly techniques.
	g.	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.	**HAZARDS IN THE WORKPLACE**	
	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.	Aircraft Act and Rules made under the ICAO role of the DGCA
	c.	Relationship between CAR-21, CAR-M, CAR-145, CAR-66, CAR 147.
	d.	The Aircraft Rules (Applicable to Aircraft Maintenance and Release)
	e.	Aeronautical Information Circulars (Applicable to Aircraft Maintenance and Release)
	f.	CAR Section 1 and 2
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.	**AIRCRAFT OPERATIONS**	
	a.	Commercial Air Transport/Commercial Operations;
	b.	Air Operators Certificates;
	c.	Operators Responsibilities, in particular regarding continuing airworthiness and maintenance;
	d.	Documents to be carried on board;
	e.	Aircraft Placarding (Markings);
10.5.	**AIRCRAFT CERTIFICATION**	
	a.	General – Certification rules: such as FAA & EACS 23/25/27/29;
	b.	Type Certification;
	c.	Supplemental Type Certification;
	d.	CAR-21 Design/Production Organization Approvals.
	e.	Aircraft Modifications and repairs approval and certification
	f.	Permit to fly requirements
	g.	Documents- Certificate of Airworthiness;
	h.	Certificate of Registration;
	i.	Noise Certificate;
	j.	Weight Schedule;
	k.	Radio Station License and Approval.

MODULE 10 – AVIATION LEGISLATION		
Sl. No.	**Topics to be Covered**	
10.6.	**CAR – M**	
	a.	Detail understanding of CAR M provisions related to Continuing Airworthiness
	b.	Detailed understanding of CAR-M.
10.7.	**APPLICABLE NATIONAL AND INTERNATIONAL REQUIREMENTS**	
	a.	Maintenance Programme, Maintenance checks and inspections;
	b.	Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists;
	c.	Airworthiness Directives; Service Bulletins, manufacturers service information; Modifications and repairs
	d.	Maintenance documentation: maintenance manuals, structural repair manual, Illustrated parts catalogue, etc.;
	e.	Continuing airworthiness;
	f.	Test flights;
	g.	ETOPS /EDTO, maintenance and dispatch requirements;
	h.	RVSM, maintenance and dispatch requirements
	i.	RNP, MNPS Operations, All Weather Operations
	j.	Category 2/3 operations and minimum equipment requirements.
10.8.	**SAFETY MANAGEMENT SYSTEM**	
	a.	State Safety Programme
	b.	Basic Safety Concepts
	c.	Hazards & Safety Risks
	d.	SMS Operation
	e.	SMS Safety performance
	f.	Safety Assurance
10.9.	**FUEL TANK SAFETY**	
	a.	Special Federal Aviation Regulations (SFARs) from 14 CFR SFAR 88 of the FAA and of JAA TGL 47
	b.	Concept of CDCCL
	c.	Airworthiness Limitations Items (ALI)

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS			
Sl. No.	**Topics to be Covered**		
13.1.	**THEORY OF FLIGHT**		
	a.	Aeroplane Aerodynamics and Flight Controls Operation and effect of:	
		i.	Roll control: ailerons and spoilers,
		ii.	Pitch control: elevators, Stabilator, variable incidence stabilizers and canards,
		iii.	Yaw control, rudder limiters;
	b.	Control using Elevons, Ruddervators;	
	c.	High lift devices: slots, slats, flaps;	
	d.	Drag inducing devices: spoilers, lift dumpers, speed brakes;	
	e.	Operation and effect of trim tabs, servo tabs, control surface bias;	
	f.	High Speed Flight;	
	g.	Speed of sound, subsonic flight, transonic flight, supersonic flight;	
	h.	Mach number, critical Mach number;	
	i.	Rotary Wing Aerodynamics terminology;	
	j.	Operation and effect of cyclic, collective and anti-torque controls.	
13.2.	**STRUCTURES — GENERAL CONCEPTS**		
	a.	Fundamentals of structural systems;	
	b.	Zonal and station identification systems;	
	c.	Electrical bonding;	
	d.	Lightning strike protection provision.	
13.3.	**ELECTRICAL POWER (ATA 24)**		
	a.	Batteries Installation and Operation;	
	b.	DC power generation;	
	c.	AC power generation;	
	d.	Emergency power generation;	
	e.	Voltage regulation;	
	f.	Power distribution;	
	g.	Inverters, transformers, rectifiers;	
	h.	Circuit protection;	
	i.	External/Ground power.	
13.4.	**EQUIPMENT AND FURNISHINGS (ATA 25)**		
	a.	Electronic emergency equipment requirements;	
	b.	Cabin entertainment equipment.	
13.5.	**INSTRUMENTS (ATA 31)**		
	a.	Classification;	
	b.	Atmosphere;	

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS		
Sl. No.	**Topics to be Covered**	
13.5. Cont…	c.	terminology;
	d.	Pressure measuring devices and systems;
	e.	Pitot static systems;
	f.	Altimeters;
	g.	Vertical speed indicators;
	h.	Airspeed indicators;
	i.	Machmeters;
	j.	Altitude reporting/alerting systems;
	k.	Air data computers;
	l.	Instrument pneumatic systems;
	m.	Direct reading pressure and temperature gauges;
	n.	Temperature indicating systems;
	o.	Fuel quantity indicating systems;
	p.	Gyroscopic principles;
	q.	Artificial horizons;
	r.	Slip indicators;
	s.	Directional gyros;
	t.	Ground Proximity Warning Systems;
	u.	Compass systems;
	v.	Flight Data Recording systems;
	w.	Electronic Flight Instrument Systems;
	x.	Instrument warning systems including master warning systems and centralized warning panels;
	y.	Stall warning systems and angle of attack indicating systems;
	z.	Vibration measurement and indication;
	aa.	Glass cockpit
13.6.	**FLIGHT CONTROLS (ATA 27)**	
	a.	Primary controls: aileron, elevator, rudder, spoiler;
	b.	Trim control;
	c.	Active load control;
	d.	High lift devices;
	e.	Lift dump, speed brakes;
	f.	System operation: manual, hydraulic, pneumatic, electrical, fly-by-wire;
	g.	Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks systems;
	h.	Balancing and rigging;
	i.	Stall protection/warning system.

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS			
Sl. No.	**Topics to be Covered**		
13.7.	**AUTO FLIGHT (ATA 22)**		
	a.	Fundamentals of automatic flight control including working principles and current terminology;	
	b.	Command signal processing;	
	c.	Modes of operation: roll, pitch and yaw channels;	
	d.	Yaw dampers;	
	e.	Stability Augmentation System in helicopters;	
	f.	Automatic trim control;	
	g.	Autopilot navigation aids interface;	
	h.	Auto throttle systems;	
	i.	Automatic Landing Systems: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions	
13.8.	**COMMUNICATION/NAVIGATION (ATA 23/34)**		
	a.	Fundamentals of radio wave propagation, antennas, transmission lines, communication,receiver and transmitter	
	b.	Working principles of following systems:	
		i.	Very High Frequency (VHF) communication,
		ii.	High Frequency (HF) communication,
		iii.	Audio,
		iv.	Emergency Locator Transmitters,
		v.	Cockpit Voice Recorder,
		vi.	Very High Frequency omnidirectional range (VOR),
		vii.	Automatic Direction Finding (ADF),
		viii.	Instrument Landing System (ILS),
		ix.	Microwave Landing System (MLS),
		x.	Flight Director systems, Distance Measuring Equipment (DME),
		xi.	Very Low Frequency and hyperbolic navigation (VLF/Omega),
		xii.	Doppler navigation,
		xiii.	Area navigation, RNAV systems,
		xiv.	Flight Management Systems,
		xv.	Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS),
		xvi.	Inertial Navigation System,
		xvii.	Air Traffic Control transponder, secondary surveillance radar,
		xviii.	Traffic Alert and Collision Avoidance System (TCAS),
		xix.	Weather avoidance radar,
		xx.	Radio altimeter,
		xxi.	ARINC communication and reporting.

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS			
Sl. No.	**Topics to be Covered**		
13.9.	**OXYGEN (ATA 35)**		
	a.	System lay-out: cockpit, cabin;	
	b.	Sources, storage, charging and distribution;	
	c.	Supply regulation;	
	d.	Indications and warnings.	
13.10.	**PNEUMATIC/ VACUUM (ATA 36)**		
	a.	System lay-out;	
	b.	Sources: Engine/ APU, compressors, reservoirs, ground supply;	
	c.	Pressure control;	
	d.	Distribution;	
	e.	Indications and warnings;	
	f.	Interfaces with other systems	
13.11.	**FIRE PROTECTION (ATA 26)**		
	a.	Fire and smoke detection and warning systems;	
	b.	Fire extinguishing systems;	
	c.	System tests;	
	d.	Portable fire extinguisher	
13.12.	**LIGHTS (ATA 33)**		
	a.	External: navigation, landing, taxiing, ice;	
	b.	Internal: cabin, cockpit, cargo;	
	c.	Emergency.	
13.13.	**AIR CONDITIONING AND CABIN PRESSURIZATION (ATA 21)**		
	a.	Air supply: Sources of air supply including engine bleed, APU and ground cart;	
	b.	Air Conditioning:	
		i.	Air conditioning systems;
		ii.	Air cycle and vapor cycle machines;
		iii.	Distribution systems;
		iv.	Flow, temperature and humidity control system.
	c.	Pressurization	
		i.	Pressurization systems;
		ii.	Control and indication including control and safety valves;
		iii.	Cabin pressure controllers.
	d.	Safety and warning devices	
		i.	Protection and warning devices.

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS		
Sl. No.	**Topics to be Covered**	
13.14.	**FUEL SYSTEMS (ATA 28)**	
	a.	System lay-out;
	b.	Fuel tanks;
	c.	Supply systems;
	d.	Dumping, venting and draining;
	e.	Cross-feed and transfer;
	f.	Indications and warnings;
	g.	Re-fuelling and defueling;
	h.	Longitudinal balance fuel systems.
13.15.	**HYDRAULIC POWER (ATA 29)**	
	a.	System lay-out;
	b.	Hydraulic fluids;
	c.	Hydraulic reservoirs and accumulators;
	d.	Pressure generation: electrical, mechanical, pneumatic;
	e.	Emergency pressure generation;
	f.	Filters;
	g.	Pressure control;
	h.	Power distribution;
	i.	Indication and warning systems;
	j.	Interface with other systems.
13.16.	**LANDING GEAR (ATA 32)**	
	a.	Construction, shock absorbing;
	b.	Extension and retraction systems: normal and emergency;
	c.	Indications and warnings;
	d.	Wheels, brakes, antiskid and auto braking;
	e.	Tyres;
	f.	Steering;
	g.	Air-ground sensing.
13.17.	**ICE AND RAIN PROTECTION (ATA 30)**	
	a.	Ice formation, classification and detection;
	b.	Anti-icing systems: electrical, hot air and chemical;
	c.	De-icing systems: electrical, hot air, pneumatic, chemical;

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS			
Sl. No.	**Topics to be Covered**		
13.17. Cont…	d.	Rain repellent;	
	e.	Probe and drain heating;	
	f.	Wiper Systems.	
13.18.	**WATER/ WASTE (ATA 38)**		
	a.	Water system lay-out, supply, distribution, servicing and draining;	
	b.	Toilet system lay-out, flushing and servicing.	
13.19.	**ON BOARD MAINTENANCE SYSTEMS (ATA 45)**		
	a.	Central maintenance computers;	
	b.	Data loading system;	
	c.	Electronic library system;	
	d.	Printing;	
	e.	Structure monitoring (damage tolerance monitoring).	
13.20.	**INTEGRATED MODULAR AVIONICS (ATA 42)**		
	a.	Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others:	
		i.	Bleed Management,
		ii.	Air Pressure Control,
		iii.	Air Ventilation and Control,
		iv.	Avionics and Cockpit Ventilation Control,
		v.	Temperature Control,
		vi.	Air Traffic Communication,
		vii.	Avionics Communication Router,
		viii.	Electrical Load Management,
		ix.	Circuit Breaker Monitoring,
		x.	Electrical System BITE,
		xi.	Fuel Management,
		xii.	Braking Control,
		xiii.	Steering Control,
		xiv.	Landing Gear Extension and Retraction,
		xv.	Tyre Pressure Indication,
		xvi.	Oleo Pressure Indication,
		xvii.	Brake Temperature Monitoring, etc.;

MODULE 13 – AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS			
Sl. No.	**Topics to be Covered**		
13.20. Cont…	b.	Core System;	
	c.	Network Components.	
13.21.	**CABIN SYSTEMS (ATA 44)**		
	a.	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.	
	b.	The Cabin Intercommunication Data System provides an interface between cockpit/ cabin crewand cabin systems. These systems support data exchange of the different related LRU's and they are typically operated via Flight Attendant Panels.	
	c.	The Cabin Network Service typically consists on a server, typically interfacing with, among others, the following systems:	
		i.	Data/ Radio Communication, In-Flight Entertainment System.
	d.	The Cabin Network Service may host functions such as:	
		i.	Access to pre-departure/departure reports,
		ii.	E-mail/intranet/ Internet access,
		iii.	Passenger database;
	e.	Cabin Core System;	
	f.	In-flight Entertainment System;	
	g.	External Communication System;	
	h.	Cabin Mass Memory System;	
	i.	Cabin Monitoring System;	
	j.	Miscellaneous Cabin System.	
13.22.	**INFORMATION SYSTEMS (ATA 46)**		
	a.	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.	
		Typical examples include Air Traffic and Information Management Systems and Network Server Systems	
		i.	Aircraft General Information System;
		ii.	Flight Deck Information System;
		iii.	Maintenance Information System;
		iv.	Passenger Cabin Information System;
		v.	Miscellaneous Information System.

MODULE 14 – PROPULSION		
Sl. No.	**Topics to be Covered**	
14.1.	**TURBINE ENGINES**	
	a.	Constructional arrangement and operation of turbojet, turbofan, turbo shaft and turbo propeller engines;
	b.	Electronic Engine control and fuel metering systems (FADEC).
14.2.	**ENGINE INDICATING SYSTEMS**	
	a.	Exhaust gas temperature/Interstage turbine temperature systems;
	b.	Engine speed;
	c.	Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems;
	d.	Oil pressure and temperature;
	e.	Fuel pressure, temperature and flow;
	f.	Manifold pressure;
	g.	Engine torque;
	h.	Propeller speed.
14.3.	**STARTING AND IGNITION SYSTEMS**	
	a.	Operation of engine start systems and components;
	b.	Ignition systems and components;
	c.	Maintenance safety requirements