

Aeronautical Engineering (Electrical) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware - I	
	Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Aircraft Aerodynamics, Structures and Systems (Basic Instrument)	
	Electronic Fundamental	
	Materials and Hardware - II	
	Maintenance Practices (Non Destructive Technique & Aircraft Handling)	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-I)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-I)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-II)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-II)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Applied Mathematics	
	Physics	

Semester -VII

Code No.	Papers	Credit
Theory Papers		
	Production Planning and Control	
	Management of System	
	Control Theory & Practice	

Semester -VIII

Code No.	Papers	Credit
Theory Papers		
	Air Navigation	
	Industrial Training	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section -1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III, DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules 1937 & CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America;

Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.

3. **Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

1. Fundamentals of structural systems.
2. Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II

ELECTRICAL FUNDAMENTALS

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section - 2 & AAC: MODIFICATIONS, Rule - 52, Series M Part I, 1 of 1996 - Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section - 2 & AAC: Licensing: Rule - 17, 19, 61, Series L Part 11 to XV, 7 of 2000 - Issue of certificate of Competency, 8 of 2000 - Refresher training for AME / APP.5 of 1998 - Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section - 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule - 25, 25A, 25B, Series H - Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD AND TRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non Ferrous materials used in aircraft, heat treatment and application of non Ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure and Systems

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

Aircraft Aerodynamics, Structures and Systems (Basic Instrument)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms: Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting.

Electronic Fundamental

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits;
Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System

ECAM – Electronic Centralized Aircraft Monitoring

EFIS – Electronic Flight Instrument System

EICAS – Engine Indication and Crew Alerting System

FBW – Fly by Wire

FMS – Flight Management System

GPS – Global Positioning System

IRS – Inertial Reference System

TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

MATERIALS AND HARDWARE - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

Sem-IV

Aircraft Aerodynamics Structures and Systems (Electrical Part-I)

Electrical Power (ATA 24) (Generation): Batteries Installation and Operation; DC Power Generation; Voltage regulation. **Introduction to primary and secondary cells,** Lead acid battery construction, Batteries charging in shop & aircraft (constant current , constant voltage method), Internal resistance & Rating of batteries, Capacity / Load testing, Chemical action on Ni-cad batteries, Charging procedure on Ni-cad batteries, Lower & upper nut torque check procedure, Emf induced in a rotating loop & production of direct current, Identification & function of various parts like yoke, field magnets, armature, commutator & brushes, Types of DC generators, Maintenance procedure of generators, Types of voltage regulators, Alternator construction, Frequency wild alternator, Switches, Relays, Circuit breaker.

Aircraft Aerodynamics Structures and Systems **(Instrument Part-I)**

Instrument Systems (ATA 31): Classification; Atmosphere; Terminology; Pressure measuring devices and systems; Pitot static systems; Altimeters; Vertical speed indicators; Airspeed indicators; Mach meters; Altitude reporting/ alerting systems; Air data computers; Instrument pneumatic systems; Direct reading pressure and temperature gauges; Temperature indicating systems; Fuel quantity indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems; Compass systems; Flight Data Recording Systems; Electronic Flight instrument Systems; Instrument warning systems including master warning systems. Vibration measurement and indication.

On board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Aircraft Aerodynamics Structures and Systems **(Communication/ Navigation Part-I)**

Communication (ATA 23): Fundamental of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; working principles of following systems:

- Emergency Locator Transmitters;
- Flight Management Systems;
- Global Positioning System (GPS),
- Global Navigation
- Satellite Systems (GNSS);
- Inertial Navigation System;
- Traffic Alert and Collision Avoidance System (TCAS);

Equipment and Furnishings (ATA 25): Electronic emergency equipment requirements; Cabin entertainment equipment.

Sem-V

Aircraft Aerodynamics Structures and Systems **(Electrical Part-II)**

5 Electrical Power (Distribution): Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Aircraft Aerodynamics Structures and Systems **(Instrument Part-II)**

Auto flight (ATA 22): Fundamental of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface; Autothrottle systems; Automatic Landing System: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.

Flight Controls (ATA 27): Primary Control; aileron, elevator, rudder, spoiler; Trim Control; Active load control; High lift device; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks; Stall protection system. **b)** System operation: electrical, fly by wire.

Aircraft Aerodynamics Structures and Systems **(Communication/ Navigation Part-II)**

Navigation (ATA 34): Very High Frequency (VHF) communication; High Frequency (HF) communication; Audio; Cockpit Voice Recorder; Very High Frequency omnidirectional range (VOR); Automatic Direction Finding (ADF); Instrument Landing System (ILS); Microwave Landing System (MLS); Flight Director systems; Distance Measuring Equipment (DME); Doppler navigation; Area navigation, RNAV systems; Weather avoidance radar; Radio altimeter; Air Traffic Control transponder, secondary surveillance radar; ARINC communication and reporting.

Sem-VI **Principles of Management**

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Cauchy's root test, D'Alembert's Ratio Test, Gauss test, De Moivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable. Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems. 2

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition.

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules, Chemical Compounds. States: Solid, Liquid and Gaseous, Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler Effect.

Sem-VII **Production Planning & Control**

Scope of Production Management: Elements of production-the production cycle-Necessity for planning and control-analysis of production planning and control functions. Production planning control as the nerve system of the production unit.

Factors affecting planning, forecasting information necessary for pre-planning. Sources of information. Methods of forecasting, aircraft components requiring overhaul, repair, modifications, premature, failures, Project planning. Estimates of plant, machinery, buildings, manpower, materials, spare parts, time and cost estimates.

Materials, Machines and Processes: Production engineering knowledge necessary for planning, machine tools and processes. Materials including aircraft materials and their processing, Spare parts required for overhaul and maintenance. Ground handling equipment. Testing of components and aircraft after overhaul. Standards for acceptance after overhaul.

Equipment and Tools: Pre-planning required for provision of special tools, jigs, fixtures and test equipment required for overhaul and maintenance. Types and description of major test equipment.

Production Planning: Production planning function of routing estimating and scheduling-LOB-CPM and PER T. Queing theory, sequencing in jobs, shop scheduling. Assembly line balancing. Charts and graphs.

Production Control: Production control functions of dispatching, progressing and evaluation. Activities of progressing. Shop procedures. Maintenance of critical data statistics of evaluation control charts.

Design of PPC Systems: PPC as management information. System design parameters. Charting information for systems charts.

ORGANISING FOR PPC: Centralized and decentralized systems. Organizing PPC around information flow-concepts and practices in Indian Airlines and Air India, practices in other countries.

Text Books and Reference Books:

1. Frankling S Moore, Production Control, McGraw Hill.
2. E H MacNiec, Production Forecasting Planning and Control John Wiley.
3. Landy Thomas, Production Planning and Control M, McGraw Hill.
4. Carson Gordon, Production Hand Book B Ronald Press Company.
5. Mages John F., Production Planning and Inventory Control, McGraw Hill.
6. Churchman, Operations Research, Ackoff and Arnoff.
7. Hoffman and Wadsworth, Production Management and Manufacturing Systems.
8. K C Batra, Production Management.

Management of System

Systems Approach to Management: Systems concept; Types and characteristics of manufacturing and service systems; overall conceptualization of business systems, model building; Planning, analysis and control of engineering systems; Communication for planning and control.

Organisational Concepts: Management hierarchy for different types of industry: Organisation principles, structures, tools for coordination and planning

Human Resource Development: Management function for human resource planning-people, profit and productivity. Staffing, recruitment policy, training and development programmes, motivation, incentive and promotion policies, collective decision-making, trade unions and collective bargaining.

Projectology: Project formulation and implementation strategies. Monitoring and control of projects. Project evaluation - benefit - cost analysis.

Management Information System: Significance of information as a corporate resource. Identification, collection, storage and retrieval of information. Frequency of reporting and updating. Introduction to Decision Support Systems.

Planning and Control of Production Systems: Product design and development, product life cycle; Demand analysis and forecasting - Time series analysis, simple exponential smoothing models, input - output analysis. Resource requirement planning. Basic models for shop loading, sequencing and scheduling. Materials requirement planning. Management functions for planning maintenance, maintenance strategies.

Managerial Economics: Concepts of managerial economics; Production and cost analysis; Managerial uses of production and demand functions. Determinants of price - pricing under different objectives. Role, objective and goals of financial management.

Text Books:

1. E S Buffa, Modern Production/Operation management, ES., Wiley Eastern, New Delhi
2. Gupta A K, Management of Systems, Macmillan Book CO., New Delhi
3. Chary S N, Production and Operations Management, Tata McGraw Hill Book Co., New Delhi

Reference Books:

1. S C Keshu & KK Ganapathy, Aircraft Production Technology and Management, Interline Publications
2. Palmer, Maintenance, Planning and Scheduling Manual, McGraw Hill
3. Wright, Management of Organisation, McGraw Hill

Control Theory & Practice

Introduction to Laplace transform, Fourier transforms, Definition of feedback terms, symbols to represent feedback control variables, characteristics of basic feedback loop. Introduction to dynamics of stable and unstable vehicles. Definition of Aerodynamic coefficients, force and moment equations, definition of relaxed static stability , CCV concept in modern flight control system.

Models of Components and Systems: Its variables and equations, modeling of passive electrical components and systems, static and dynamic variables, modeling of DC motors and servo systems, transducer, sensors and actuators, transport delay.

Frequency response analysis:

- a) Open loop and closed loop poles and zeros
- b) Nyquist diagram
- c) Nyquist stability criterion
- d) Stability margins, illustration of phase margin and gain margins

The BODE magnitude plot: Studies on BODE phase plot, stability margins on the BODE plot, Time delay effects.

The roots focus method: the locus equations, properties and sketching rules, loci for systems.

Time Response: Steady state error, transient response to a input, performance measures.

System design: (a) Signal conversion and processing: Digital signals and coding, data conversions and quatization sample and hold devices, digital to analog conversion, analog to digital conversion, the sampling theorem, reconstruction of sampled signals. (b) Compensation networks, system effects of offset and noise. (c) Servo components: Synchros, Sensors, actuators, computers (d) Electronic design aspects: rating, time delays, reasonable values, etc. proportional controller, proportional integral controller, proportional integral differential controller (PID)

The Z-Transform: (a) Definition of Z Transform (b) Evaluation of Z Transform (c) Mapping between s-plane and the z-plane (d) the inverse Z transform (e) Theorems of Z transform.

The State Variable Technique: (a) State equations and state transition equations of continuous data system (b) State transition equations of digital systems (c) Relation between state equation and transfer function (d) Characteristic equation, eigen values and eigen vectors (e) Diagonalisation of A matrix (f) Methods of computing the state transition of A matrix.

Stability of digital control system, time domain analysis, frequency domain analysis.

Text Books:

1. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall of India
2. Robert C Nelson, Flight Stability and Automatic Control, McGrawHill, New York
3. B Etkin, Dynamics of Aircraft, McGraw Hill, New York

Reference Books:

1. Duglas B Miron, Design of Feed Back Systems, Harcourt Brace Jovanovic Publications, NY
2. Benjamin C Kuo, Digital Control Systems
3. Mc Ruer, Ashkenaus and Graham, Aircraft Dynamics and Controls, Princeton Univ. Press, NJ.

Sem-VIII

Air Navigation

The Problems of Air Navigation: The Aircraft, Aids of Navigation VOR, ADF, ILS, MLS, GCA, DME, TACAN. Doppler and basics of inertial navigation inertial reference system, Their limitations and uses. Weather, Air Traffic Control, Communications, GPS, TACAS, ATC Interrogation Radar.

The Earth: Its Form & Features: Principle Physical Features of the Earth, Latitude, Sidereal Time. The Seasons, Climate, Duration of daylight, Chart Projection for Air Navigation : The Round Earth on a Flat Chart. Properties obtainable in Projection. Distance on Sphere. Direction on a Sphere. The Lambert Projection. The Mercator Projection, The Gnomonic Projection. The Stereographic Projection. Projections for Weather Charts. Calculation on Rhumb Line Tracks and distances.

Magnetism: Review of the Elementary laws of magnetism. Terrestrial magnetism, Horizontal and vertical components of earth's magnetic field and their variation with latitude. Isogonic and agonic lines. Isoclinic lines. Aircraft Magnetism; Resolution into P, Q and R components, coefficients and deviation associated with them, compass course deviation.

Instruments: Units of measurement of distances and height. The function of navigational Instruments. The Speed Indicator. The Rate of Climb indicator. The Altimeter. The magnetic Compass. The Turn and Bank indicator. The Directional Gyro. The Artificial Horizon. Radio, Radar Altimeter. Machmeter. Fluxgate Compass ADI, HSI and RMI.

Chart Reading: Distinctive Properties of Charts. The importance of chart reading. Topographic Information. Aeronautical Data. Legend and written Notes. The practice of Chart Reading.

Dead Reckoning: The place of Pilotage. Advantage of Dead Reckoning. Basic Problems in Dead Reckoning.

Special Problems & Dead Reckoning: Climb and Descent. Off-course corrections. Double Drift. Radius of Action. Cruise Control. Alternate Airport Problem. Interception. Tracking Equal time point, point of safe return.

Air Navigation Computers: Function and Usefulness. The Slide Rule Side. The Wind Triangle Side.

Radio Navigation: Principles of radio transmission and reception; properties of electromagnetic waves; classification of frequency bands, elementary knowledge of Radar.

An elementary knowledge of principles of the following radio and radar aids and systems:

Airborne D/F: The manual loop and automatic radio compass including methods of Calibration.

Ground D/F: M.F., H.F. and V.H.F. Systems.

Radio/Radar track guides approach and landing aids and systems including V.O.R., N.D.B., I.L.S. and M.L.S.

Plotting Radio Bearings on Mercator Charts and Lambert Chart. Relating Bearings.

Celestial Navigation: Elements of Astronomy; the universe; Solar system, movements of earth, moon and planets, earth's orbit; Kepler laws, declination, altitude, azimuth etc. Practical Value. Accuracy. Simplicity. Basic principles. The Line of position. Celestial Coordinates. Determining the Greenwich Hour Angle (GHA) Determining the Local Hour Angle (LHA). A Line of position from Polaris. A Line of Position from an Unidentified Star. Radio Time Signals. Identification of Stars. Star Names. Brightness of Star. The planets. Motion of the Stars and Planets. The Practice of Celestial Navigation. Astro-Navigation instruments.

The Practice of Navigation: Details of Navigation. Preparation of Charts for use in Flight Pilotage. Contact Instrument Flying. Future Air Navigation system(FANS), Cruise controls, Flight planning using charts and tables, Extended Range Operations, Aircraft Performance.

Pressure Pattern Flying.

Text Books and Reference Books:

1. The Air Pilot's Manual, Flying Training Vol.3, Airlife Publishing
2. J E Hitercock, Navigation for Pilots, Airlife Publishing 1997
3. R B Underdown, Ground Studies for Pilots, Vol.3, Blackwell
4. Trevor Thom, Air Navigation, Airlife Publishing
5. A E Bramson and N H Birch, Radio Navigation for Pilots, Airlife Publishing 1984.

Industrial Training

Aeronautical Engineering (Mechanical) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware - I	
	Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Aircraft Aerodynamics, Structures and Systems (Basic Instrument)	
	Electronic Fundamental	
	Materials and Hardware - II	
	Maintenance Practices (Non Destructive Technique & Aircraft Handling)	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-I)	
	Turbine Aeroplane Aerodynamics, Structure (Part-I) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-II)	
	Turbine Aeroplane Aerodynamics, Structure (Part-II) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Applied Mathematics	
	Physics	

Semester -VII

Code No.	Papers	Credit
Theory Papers		
	Engineering Thermodynamics	
	Production Planning & Control	
	Fluid Mechanics	

Semester -VIII

Code No.	Papers	Credit
Theory Papers		
	Strength of Material	
	Management of System	
	CAD-CAM	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section –1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules1937 &CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.
- 3. Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

- 1.** Fundamentals of structural systems.
- 2.** Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II

ELECTRICAL FUNDAMENTALS

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section – 2 & AAC: MODIFICATIONS, Rule – 52, Series M Part I, 1 of 1996 – Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section – 2 & AAC: Licensing: Rule – 17, 19, 61, Series L Part 11 to XV, 7 of 2000 – Issue of certificate of Competency, 8 of 2000 – Refresher training for AME / APP.5 of 1998 – Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section – 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule – 25, 25A, 25B, Series H – Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD ANDTRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non Ferrous materials used in aircraft, heat treatment and application of non Ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems **(Basic Computer Structure, Micro Processor and** **Software Management Control)**

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure and Systems

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS (BASIC INSTRUMENT)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms:

Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting.

ELECTRONIC FUNDAMENTAL

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System

ECAM – Electronic Centralized Aircraft Monitoring

EFIS – Electronic Flight Instrument System

EICAS – Engine Indication and Crew Alerting System

FBW – Fly by Wire

FMS – Flight Management System

GPS – Global Positioning System

IRS – Inertial Reference System

TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

MATERIALS AND HARDWARE - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and beaming/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

SEM-IV
Gas Turbine Engine, Piston Engine & Propeller
(Part-I)

Fundamentals 1 2: Mechanical, thermal and volumetric efficiencies; Operating principles — 2 stroke, 4 stroke, Otto and Diesel; Piston displacement and compression ratio; Engine configuration and firing order.

Engine Performance 1 2: Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.

Engine Construction 1 2: Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; Propeller reduction gearboxes.

Engine Fuel Systems, Carburetors 1 2: Types, construction and principles of operation; Icing and heating.

Fuel injection systems 1 2: Types, construction and principles of operation.

Electronic engine control 1 2: Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.

Starting and Ignition Systems 1 2: Starting systems, pre-heat systems; Magneto types, construction and principles of operation; Ignition harnesses, spark plugs; Low and high tension systems.

Induction, Exhaust and Cooling Systems 1 2: Construction and operation of: induction systems, including alternate air systems; Exhaust systems, engine cooling systems — air and liquid.

Supercharging/Turbo charging 1 2: Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/turbo charging systems; System terminology; Control systems; System protection.

Lubricants and Fuels 1 2: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems 1 2: System operation/lay-out and components.

Engine Indication Systems: Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.

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.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer.

Engine Storage and Preservation: Preservation and depreservation for the engine and accessories/ systems.

PROPELLER

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.

Propeller Construction 1 2: 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.

Propeller Pitch Control: Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Over speed protection.

Propeller Synchronizing: Synchronizing and synchrophasing equipment.

Propeller Ice Protection: Fluid and electrical de-icing equipment

Propeller Maintenance: Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, Impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.

Propeller Storage and Preservation: Propeller preservation and depreservation.

Turbine Aeroplane Aerodynamics, Structure (Part-I) **and Piston Aeroplane Aerodynamics** **Structures and systems (Part-I)**

Physics of the Atmosphere: International Standard Atmosphere (ISA), application to aerodynamics.

Aerodynamics: Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Aeroplane Aerodynamics and Flight Controls Operation and effect of: Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stabilators, variable incidence stabilizers and canards; yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flapersons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;

High Speed Flight: Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.

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; Lightning strike protection provision.

b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, 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.

Fuselage: Construction and pressurization sealing; Wing, stabilizer, pylon and undercarriage attachments; Seat installation and cargo loading system; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.

Wings: Construction; Fuel storage, Landing gear, pylon control surface and high lift/drag attachments.

Stabilizers: Construction; Control surface attachment.

Flight Control Surfaces: Construction and attachment; Balancing – mass and aerodynamic.

Nacelles/Pylons: Construction; Firewalls; Engine mounts

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 locks systems; Balancing and rigging; Stall protection/warning system.

Sem-V

Gas Turbine Engine, Piston Engine & Propeller

(Part-II)

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.

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.

Inlet: Compressor inlet ducts, Effects of various inlet configurations; ice protection.

Compressors: Axial and centrifugal types; Constructional feature and operating principles and applications; Fan balancing, Operation; Causes and effect of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ration.

Combustion Section: Constructional features and principles of operation.

Turbine Section: Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes; Causes and effect of turbine blade stress and creep.

Exhaust: Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.

Bearings and Seals: Constructional features and principles of operation.

Lubricants and Fuels: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems: System operation/lay-out and components.

Fuel Systems: Operation of engine control and fuel metering systems including electronic engine control (FADEC); System lay-out and components.

Air Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Starting and Ignition Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Engine Indication Systems: Exhaust Gas Temperature/Interstage Turbine, Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication; Torque; Power.

Power Augmentation Systems: Operation and applications; Water injection, water methanol; Afterburner systems.

Turbo-prop Engines: Gas coupled/free turbine and gear coupled turbines; Reduction gears; integrated engine and propeller controls; Overspeed safety devices.

Turbo-shaft engines: Arrangements, drive systems, reduction gearing, couplings, control systems.

Auxiliary Power Units (APUs): Purpose, operation, protective systems

Power plant Installation: Configuration of firewalls, cowlings, acoustic panels, and engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.

Fire Protection Systems: Operation of detection and extinguishing systems.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring;

Engine Storage and Preservation – 2: Preservation and depreservation for the engine and accessories/systems.

Turbine Aero plane Aerodynamics, Structure (Part-II) **and Systems & Piston Aero plane Aerodynamics** **Structures and systems (Part-II)**

Air Conditioning and Cabin Pressurization and Air supply: Pressurization and air conditioning systems; Cabin pressure controllers, protection and warning devices. Sources of air supply including engine bleed, APU and ground cart.

Air Conditioning: Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.

Pressurization: Pressurization systems; Control and indication including control and safety valves; Cabin pressure controllers.

Safety and warning devices: Protection and warning devices.

Instruments/Avionic Systems and Instrument Systems: Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Other aircraft system indication.

Avionic Systems: Fundamentals of system lay-outs and operation of; Auto Flight (ATA 22); Communications (ATA 23) Navigation Systems (ATA 34).

Electrical Power (ATA 24): Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Equipment and Furnishings (ATA 25): Emergency equipment requirements; Seats, harnesses and belts. Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.

Fire Protection (ATA 26): Fire and smoke detection and warning systems .Fire extinguishing systems; System tests.

Fuel Systems (ATA 28): System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refueling and defueling; Longitudinal balance fuel systems.

Hydraulic Power (ATA 29): System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.

Ice and Rain Protection (ATA 30): Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, pneumatic and chemical; Rain repellent and removal; Probe and drain heating.

Landing Gear (ATA 32) 2 3: Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and auto braking; Tyres; Steering.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Oxygen (ATA 35): System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.

Pneumatic/Vacuum (ATA 36): System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure Control; Distribution; Indications and warnings; Interfaces with other systems.

Water/Waste (ATA 38): Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.

On Board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Sem-VI

Principles of Management

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Cauchy's root test, D'Alembert's Ratio Test, Gauss test, Demoiivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable. Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems. 2

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules, Chemical Compounds. States: Solid, Liquid and Gaseous, Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler Effect.

Sem-VII

Engineering Thermodynamics

Fundamental Concepts and Definitions: Scope and limitations of thermodynamics. Thermodynamic system, state, property, change of state, thermodynamic equilibrium, path process, cycle density, pressure and their molecular interpretation - dimension and units - Zeroth law of thermodynamics and concept of temperature, temperature scales, work and heat definition and units of work and heat, work of frictionless process, PV diagram, indicator diagram.

First law of Thermodynamics: Statement of the first law. Energy. Internal energy and its microscopic interpretation, enthalpy, applications of first law.

Steady Flow Energy Equation (SFEE). The steady - state, steady -flow process. The Joule- Thomson coefficient and the throttling process. Uniform state, Uniform flow process, SFEE and its applications.

Second Law of Thermodynamics: Limitations of the first law, heat engines, reversed heat engines and their performance, Kelvin-Planck's and Clausius statements of the second law reversibility-reversible and irreversible processes: Carnot cycle thermodynamic temperature scale: Clausius-Clapeyron equation.

Entropy: The property, entropy, principle of increase of entropy, calculation of entropy changes, T -S and h-s diagrams. Microscopic interpretation of entropy-Helmholtz (A) and Gibbs (G) functions.

Physical properties: Pure substance definition-internal energy and enthalpy of a pure substance, specific heats, equilibrium of phases, phase diagrams, phase changes, critical state, PVT surface, tabulated properties and process calculations. Maxwell relations.

Ideal and Real Gases: Definition-internal energy and enthalpy, specific heats and their calculation from simple kinetic theory, gas tables, Van der Waal's equation of state, principle of corresponding states, compressibility factor.

Vapour Power Cycles: Carnot cycle using steam, Rankine cycle, reheat cycle, binary vapour cycles.

Air Standard Power Cycles: Carnot cycle, Otto cycle, Diesel cycle, dual cycle, gas turbine cycles, inter cooling, reheating and regeneration, gas turbine jet propulsion, deviation from ideal cycles.

Text Books:

1. C O Van Wylen; Classical Thermodynamics Wiley 2001
2. J B Jones and C A Hawkins, Engineering Thermodynamics, John Wiley and Sons Inc., New York
3. P K Nag, Engineering Thermodynamics, Tata Mc-Graw Hill Book Co. 1981

Reference Books:

1. R A Sonntag and C O Van Wylen, Fundamentals of Thermodynamics, Wiley, New York
2. D B Spalding and E H Cole, Engineering Thermodynamics, 2nd Ed., Arnold, London. 1973
3. John F Les and Francis W Sears, Thermodynamics: An Introductory Text for Engineering Students, Addison, Wesley Reading.

Production Planning & Control

Scope of Production Management: Elements of production-the production cycle- Necessity for planning and control-analysis of production planning and control functions. Production planning control as the nerve system of the production unit.

Factors affecting planning, forecasting information necessary for pre-planning. Sources of information. Methods of forecasting, aircraft components requiring overhaul, repair, modifications, premature, failures, Project planning. Estimates of plant, machinery, buildings, manpower, materials, spare parts, time and cost estimates.

Materials, Machines and Processes: Production engineering knowledge necessary for planning, machine tools and processes. Materials including aircraft materials and their processing, Spare parts required for overhaul and maintenance. Ground handling equipment. Testing of components and aircraft after overhaul. Standards for acceptance after overhaul.

Equipment and Tools: Pre-planning required for provision of special tools, jigs, fixtures and test equipment required for overhaul and maintenance. Types and description of major test equipment.

Production Planning: Production planning function of routing estimating and scheduling-LOB-CPM and PER T. Queing theory, sequencing in jobs, shop scheduling. Assembly line balancing. Charts and graphs.

Production Control: Production control functions of dispatching, progressing and evaluation. Activities of progressing. Shop procedures. Maintenance of critical data statistics of evaluation control charts.

Design of PPC Systems: PPC as management information. System design parameters. Charting information for systems charts.

ORGANISING FOR PPC: Centralized and decentralized systems. Organizing PPC around information flow-concepts and practices in Indian Airlines and Air India, practices in other countries.

Text Books and Reference Books:

1. Frankling S Moore, Production Control, McGraw Hill.
2. E H MacNiec, Production Forecasting Planning and Control John Wiley.
3. Landy Thomas, Production Planning and Control M,McGraw Hill.
4. Carson Gordon, Production Hand Book B Ronald Press Company.
5. Mages John F., Production Planning and Inventory Control, McGraw Hill.
6. Churchman, Operations Research, Ackoff and Arnoff.
7. Hoffman and Wadsworth, Production Management and Manufacturing Systems.
8. K C Batra, Production Management

Fluid Mechanics

Introduction: Fluids: Definition of fluids, the science of fluid mechanics, fluid properties, capillarity, surface tension, compressibility, units and dimensions.

Normal and Shear stresses in fluid flows, measurement of fluid velocity.

Regimes of fluid flows : Continuum and free molecular flow, inviscid and viscous flows, incompressible and compressible flows, Newtonian and Non-Newtonian flow, Aerodynamic force and moments, Dimensional analysis, Non-dimensional parameters, M , Re , Fr etc.

Fluid Statics: Pascal's law, types of forces on a fluid system, measurement of pressure, use of manometers and gauges, numerical problems. Hydraulic devices, forces on partially and fully submerged bodies, including that on curved surfaces, numerical problems, buoyancy, stability of floating bodies, centre of gravity and meta centric heights.

Description of Fluid Motion: Lagrangian and Eulerian methods, description of properties in a moving fluid, local and material rate of change, equation of conservation of mass for control volume.

Streamlines, path lines, streak lines, vorticity and circulation, laws of vortex motion, translation, rotation and rate of deformation of fluid particle.

Equations of Fluid Motion: Euler's and Navier Stokes equation, derivation of Bernoulli's equation for inviscid and viscous flow fields momentum equation and angular momentum equation in Integral form.

Inviscid - Incompressible Flow: Condition on velocity for incompressible flow, Laplace's equation, potential function, stream function. Basic elementary flows: uniform flows, source flows, doublet flow and vortex flow. Super -imposition of elementary flows, non lifting and lifting flow over a circular cylinder. Pressure distribution over circular cylinder in real flow. Kutta - Joukowski Theorem, Generation of lift. Lift on air foils.

Introduction to Viscous Flows : Qualitative aspects of viscous flows, viscosity and thermal conductivity, phenomenon of separation, Navier Stokes equations in vector form, viscous flow energy equation, some exact solutions of Navier Stokes equations: Plane Poiseuille flow, Couette flow, Hagen - Poiseuille flow, Hele - Shaw flow, flow through co-rotating cylinders. Transition from laminar to turbulent flow. Turbulent flow in circular pipe.

Introduction to Incompressible Boundary layer (BL): BL Concept, BL Properties, derivation of Prandtl's BL Equation, Blasius solution, Karman's Integral equation, Turbulent BL over a flat plate, skin friction drag, BL Control.

Dimensional Analysis and Similitude: Buckingham's theorem, non-dimensional groups, Geometric, Kinematic and Dynamic similarity, Applications.

Elements of Compressible Flows: Compressible flow properties total Enthalpy, total temperature, temperature and pressure ratio as function of Mach number. Mass flow parameter (MFP), Isentropic area ratio A/A^* , velocity - area variation, 2-D small amplitude wave propagation, Adiabatic Steady Flow Ellipse. Description of flow regimes, Introduction to Normal and Oblique shock waves, working out solutions through Gas Tables/Charts 4.

Text Books:

1. John D Anderson Jr., Fundamentals of Aerodynamics, McGraw Hill, 2nd Ed.
2. S W Yuan, Foundations of Fluid Mechanics, Prentice Hall
3. Gupta Vijay and Gupta S K, Fluid Mechanics and its Applications, Wiley-Eastern, 1982

Reference Books:

1. Jack D Mattingly, Principles of Gas Turbine Propulsion, 1st Ed., McGrawHill, 1997
2. H. Schlichting and K. Gersten, Boundary Layer Theory, 8th Ed., McGrawHill, 2000
3. Frank M White, Fluid Mechanics, 2nd Ed., McGrawHill, 1986
4. E. Rathakrishnan, Gas Dynamics, Prentice Hall India.

Semester -VIII

Strength of Materials

Introduction: Concept of Stress, axial loading normal stress, shearing stress, bearing stress, stress on an oblique plane under axial loading.

Deformation: Concept of strain, normal strain under axial loading, stress-strain diagrams, Hooke's law, modulus of elasticity, Poisson's ratio, thermal stresses, bulk modulus, modulus of rigidity, shearing strain, stress-strain relationship.

Transformation of Stress and Strain: Principal stresses, maximum shearing stress, Mohr's circle for plane stresses. Stresses in thin-walled pressure vessels, measurement of strain Rosette.

Pure Bending: Deformation in a transverse cross-section, derivation of formula for bending stresses. Bending stresses in composite sections.

Shearing Force and Bending Moment: Diagram for simply supported Beam, Cantilevers, with concentrated, uniformly distributed and variable loads. Castigliano's theorems, unit load method.

Deflection of Beams: Deflection in simply supported beams and cantilevers with concentrated loads, uniformly distributed loads and combination of these. Macaulay's method, moment area method.

Springs: Design of Helical (closed coiled) springs and leaf springs.

Columns: Euler formula for pin-ended columns and its extension to columns with other end conditions. Rankine Gordon formula.

Torsion: Deformation in a circular shaft, angle of twist, stresses due to torsion, derivation of torsion formula, torsion in composite shafts.

Loads on Airplane Components: Steady and unsteady load.

Text Books:

1. S Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co.
2. E P Papov, Mechanics of Materials, Prentice Hall Inc.
3. U C Jindal, Strength of Materials, Umesh Publications

Reference Books:

1. S Timoshenko, Strength of Materials, D Van Standard Co. Inc.
2. G H Ryder, Strength of Materials, B I Publications, Mumbai.

Management of System

Systems Approach to Management: Systems concept; Types and characteristics of manufacturing and service systems; overall conceptualization of business systems, model building; Planning, analysis and control of engineering systems; Communication for planning and control.

Organisational Concepts: Management hierarchy for different types of industry: Organisation principles, structures, tools for coordination and planning.

Human Resource Development: Management function for human resource planning-people, profit and productivity. Staffing, recruitment policy, training and development programmes, motivation, incentive and promotion policies, collective decision-making, trade unions and collective bargaining.

Projectology: Project formulation and implementation strategies. Monitoring and control of projects. Project evaluation - benefit - cost analysis.

Management Information System: Significance of information as a corporate resource. Identification, collection, storage and retrieval of information. Frequency of reporting and updating. Introduction to Decision Support Systems.

Planning and Control of Production Systems: Product design and development, product life cycle; Demand analysis and forecasting - Time series analysis, simple exponential smoothing models, input - output analysis. Resource requirement planning. Basic models for shop loading, sequencing and scheduling. Materials requirement planning. Management functions for planning maintenance, maintenance strategies.

Managerial Economics: Concepts of managerial economics; Production and cost analysis; Managerial uses of production and demand functions. Determinants of price-pricing under different objectives. Role, objective and goals of financial management.

Text Books:

1. E S Buffa, Modern Production/Operation management, ES., Wiley Eastern, New Delhi.
2. Gupta A K, Management of Systems, Macmillan Book CO., New Delhi.
3. Chary S N, Production and Operations Management, Tata McGraw Hill Book Co., New Delhi.

Reference Books:

1. S C Keshu & KK Ganapathy, Aircraft Production Technology and Management, Interline Publications.
2. Palmer, Maintenance, Planning and Scheduling Manual, McGraw Hill.
3. Wright, Management of Organisation, McGraw Hill.

CAD-CAM

CAD: History and development of computer aided design, hardware and software. Principle of modelling, drafting and their differences. Basic geometric entities and their representation in the data base. Manipulation of geometric entities. Verification and analysis of geometric entities. Different types of modelling, wireframe, surface and solid modelling.

Merits and demerits of different types of modelling. Display, shading and filing in modelling. Geometry data transfer between different CAD systems - use of translators. Review of existing CAD systems. Application areas and their relevance to Industrial needs. CAD interface to finite element analysis, computational fluid dynamics etc.

CAM: Concepts of NC, classification of NC Systems, CNC systems concepts and working principles, types of interpolators. Axis drives and classification of control systems, NC/CNC programming: manual, computer assisted and integrated CAD/CAM techniques. Mode and structure of NC programmes. Local and machine co-ordinate system. Codification of NC programs and tape preparation systems. Two axis, three axis and multiaxis programming for different applications.

Linear, circular and helical interpolations, co-ordinate/axis translations, rotations, axis symmetry, mirror imaging, work offsets, tool length, diameter and tool nose radius compensation. Tools and tooling for CNC, vacuum fixturing and modular tooling. Net working and distributed numerical control. Customized post processors and generic post processors. Quality control methodologies and advanced inspection techniques. CNC practices and general safety measures.

CIM: computer integrated manufacturing concepts.

Text Books and Reference Books:

1. Mikell P Groover and Zimmers Jr, CAD/CAM Computer Aided Design and manufacturing, Prentice Hall.
2. Eric Teicholz, CAD/CAM Hand Book, McGraw Hill Publications.
3. Warren S. Seames, Computer Numerical Control Concepts and Programming, Delmer Publishers Inc.

B. Tech. (Mech. Engg & AME) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware - I	
	Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Aircraft Aerodynamics, Structures and Systems (Basic Instrument)	
	Electronic Fundamental	
	Materials and Hardware - II	
	Maintenance Practices (Non Destructive Technique & Aircraft Handling)	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-I)	
	Turbine Aeroplane Aerodynamics, Structure (Part-I) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-II)	
	Turbine Aeroplane Aerodynamics, Structure (Part-II) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Applied Mathematics	
	Physics	

Semester -VII

Code No.	Papers	Credit
Theory Papers		
	Optimization	
	Design of Machine element	
	Power Plant Engineering	
	Transport Phenomena	

Semester -VIII

Code No.	Papers	Credit
Theory Papers		
	Computer Aided Manufacturing	
	Refrigeration & Air Conditioning	
	Automotive Vehicles	
	Quality Control, Assurance and Reliability	
	Dynamics of Machine & Vibrations	
	Composite Materials and Design	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section –1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules1937 &CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.
- 3. Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

1. Fundamentals of structural systems.
2. Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II **ELECTRICAL FUNDAMENTALS**

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section – 2 & AAC: MODIFICATIONS, Rule – 52, Series M Part I, 1 of 1996 – Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section – 2 & AAC: Licensing: Rule – 17, 19, 61, Series L Part 11 to XV, 7 of 2000 – Issue of certificate of Competency, 8 of 2000 – Refresher training for AME / APP.5 of 1998 – Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section – 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule – 25, 25A, 25B, Series H – Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD AND TRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non Ferrous materials used in aircraft, heat treatment and application of non Ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems **(Basic Computer Structure, Micro Processor and** **Software Management Control)**

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure **and Systems**

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

Aircraft Aerodynamics, Structures and Systems (Basic Instrument)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms: Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting.

Electronic Fundamental

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System
ECAM – Electronic Centralized Aircraft Monitoring
EFIS – Electronic Flight Instrument System
EICAS – Engine Indication and Crew Alerting System
FBW – Fly by Wire
FMS – Flight Management System
GPS – Global Positioning System

IRS – Inertial Reference System

TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

MATERIALS AND HARDWARE - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and beaming/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

Sem-IV

Gas Turbine Engine, Piston Engine & Propeller

(Part-I)

Fundamentals 1 2: Mechanical, thermal and volumetric efficiencies; Operating principles — 2 stroke, 4 stroke, Otto and Diesel; Piston displacement and compression ratio; Engine configuration and firing order.

Engine Performance 1 2: Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.

Engine Construction 1 2: Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; Propeller reduction gearboxes.

Engine Fuel Systems, Carburettors 1 2: Types, construction and principles of operation; Icing and heating.

Fuel injection systems 1 2: Types, construction and principles of operation.

Electronic engine control 1 2: Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.

Starting and Ignition Systems 1 2: Starting systems, pre-heat systems; Magneto types, construction and principles of operation; Ignition harnesses, spark plugs; Low and high tension systems.

Induction, Exhaust and Cooling Systems 1 2: Construction and operation of: induction systems, including alternate air systems; Exhaust systems, engine cooling systems — air and liquid.

Supercharging/Turbo charging 1 2: Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/turbo charging systems; System terminology; Control systems; System protection.

Lubricants and Fuels 1 2: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems 1 2: System operation/lay-out and components.

Engine Indication Systems: Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.

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.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer.

Engine Storage and Preservation: Preservation and depreservation for the engine and accessories/ systems.

PROPELLER

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.

Propeller Construction 1 2: 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.

Propeller Pitch Control: Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Over speed protection.

Propeller Synchronizing: Synchronizing and synchrophasing equipment.

Propeller Ice Protection: Fluid and electrical de-icing equipment

Propeller Maintenance: Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, Impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.

Propeller Storage and Preservation: Propeller preservation and depreservation.

Turbine Aero plane Aerodynamics, Structure (Part-I) **and Piston Aero plane Aerodynamics** **Structures and systems (Part-I)**

Physics of the Atmosphere: International Standard Atmosphere (ISA), application to aerodynamics.

Aerodynamics: Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Aeroplane Aerodynamics and Flight Controls Operation and effect of: Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stabilators, variable incidence stabilizers and canards; yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flapersons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;

High Speed Flight: Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.

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; Lightning strike protection provision.

b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, 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.

Fuselage: Construction and pressurization sealing; Wing, stabilizer, pylon and undercarriage attachments; Seat installation and cargo loading system; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.

Wings: Construction; Fuel storage, Landing gear, pylon control surface and high lift/drag attachments.

Stabilizers: Construction; Control surface attachment.

Flight Control Surfaces: Construction and attachment; Balancing – mass and aerodynamic.

Nacelles/Pylons: Construction; Firewalls; Engine mounts

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 locks systems; Balancing and rigging; Stall protection/warning system.

Sem-V **Gas Turbine Engine, Piston Engine & Propeller** **(Part-II)**

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.

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.

Inlet: Compressor inlet ducts, Effects of various inlet configurations; ice protection.

Compressors: Axial and centrifugal types; Constructional feature and operating principles and applications; Fan balancing, Operation; Causes and effect of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ration.

Combustion Section: Constructional features and principles of operation.

Turbine Section: Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes; Causes and effect of turbine blade stress and creep.

Exhaust: Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.

Bearings and Seals: Constructional features and principles of operation.

Lubricants and Fuels: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems: System operation/lay-out and components.

Fuel Systems: Operation of engine control and fuel metering systems including electronic engine control (FADEC); System lay-out and components.

Air Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Starting and Ignition Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Engine Indication Systems: Exhaust Gas Temperature/Interstage Turbine, Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication; Torque; Power.

Power Augmentation Systems: Operation and applications; Water injection, water methanol; Afterburner systems.

Turbo-prop Engines: Gas coupled/free turbine and gear coupled turbines; Reduction gears; integrated engine and propeller controls; Overspeed safety devices.

Turbo-shaft engines: Arrangements, drive systems, reduction gearing, couplings, control systems.

Auxiliary Power Units (APUs): Purpose, operation, protective systems

Power plant Installation: Configuration of firewalls, cowlings, acoustic panels, and engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.

Fire Protection Systems: Operation of detection and extinguishing systems.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring;

Engine Storage and Preservation – 2: Preservation and depreservation for the engine and accessories/systems.

Turbine Aero plane Aerodynamics, Structure (Part-II) **and Systems & Piston Aero plane Aerodynamics** **Structures and systems (Part-II)**

Air Conditioning and Cabin Pressurization and *Air supply*: Pressurization and air conditioning systems; Cabin pressure controllers, protection and warning devices. Sources of air supply including engine bleed, APU and ground cart.

Air Conditioning: Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.

Pressurization: Pressurization systems; Control and indication including control and safety valves; Cabin pressure controllers.

Safety and warning devices: Protection and warning devices.

Instruments/Avionic Systems and Instrument Systems: Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator
Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Other aircraft system indication.

Avionic Systems: Fundamentals of system lay-outs and operation of; Auto Flight (ATA 22); Communications (ATA 23) Navigation Systems (ATA 34).

Electrical Power (ATA 24): Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Equipment and Furnishings (ATA 25): Emergency equipment requirements; Seats, harnesses and belts. Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.

Fire Protection (ATA 26): Fire and smoke detection and warning systems .Fire extinguishing systems; System tests.

Fuel Systems (ATA 28): System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refueling and defueling; Longitudinal balance fuel systems.

Hydraulic Power (ATA 29): System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.

Ice and Rain Protection (ATA 30): Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, pneumatic and chemical; Rain repellent and removal; Probe and drain heating.

Landing Gear (ATA 32) 2 3: Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and auto braking; Tyres; Steering.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Oxygen (ATA 35): System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.

Pneumatic/Vacuum (ATA 36): System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure Control; Distribution; Indications and warnings; Interfaces with other systems.

Water/Waste (ATA 38): Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.

On Board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Sem-VI Principles of Management

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Caclur's root test, D'Alembarts Ratio Test, Gauss test, Demoivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable.

Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems.

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules, Chemical Compounds. States: Solid, Liquid and Gaseous, Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler Effect.

Sem-VII

Optimization

Optimization of functions of one and many variables with and without constraints; Kuhn-Tucker conditions; gradient methods; linear programming; simplex based and integer programming methods; duality theory; transportation and assignment problems; dynamic programming; branch and bound methods; models of linear production systems, sequencing and scheduling, PERT, CPM.

Design of Machine Element

Fundamentals and Principle of Design, Design and selection of machine element such as shaft, bearings and gear etc. design of mechanisms.

Power Plant Engineering

Classification of power plant, component and layout of thermal nuclear, hydro electric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economics loading of power stations. Load curve analysis, load factor, diversity factor. Power plant instrumentation and controls.

Transport Phenomena

Fundamental concept of heat transfer, steady-state and unsteady state heat conduction ,analytical and empirical relation for force and free convection heat transfer, heat exchanger analysis and design ,heat transfer and radiation, element of mass transfer , one dimensional compressible flow , flow in open channels, associated laboratory.

Sem-VIII

Computer Aided Manufacturing

Introduction, feature of NC machine tools ,NC part programming, CAM system devices, interpolators for manufacturing systems, control loops of NC system, computerized numerical control, adaptive control system, CAD to CAM, CAPP, industrial robots, computer aided production planning & control, computer aided inspection and quality control, CIM systems.

Refrigeration & Air Conditioning

Principle, thermodynamics analysis, load estimates and design of various refrigeration and air conditioning systems for comfort and industrial applications. Theoretical or experimental investigation of refrigeration and air-conditioning problems.

Automotive Vehicles

Internal combustion engine, vehicle performance, analysis and design of vehicle components. Experimental or theoretical investigation of problem selected from the field of automotive vehicles.

Quality control, Assurance and Reliability

Basis Concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributors, confidence intervals, testing significance, statistical tolerance, various type of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basis concept of reliability, reliability design evaluation and control, method of applying total quality management production process.

Dynamics of Machine & Vibrations

Dynamics force analysis in mechanism, determination of flywheel size, balance of rotating and reciprocating masses, whirling of shafts, force vibration and vibration isolation, multi degree freedom system, system with distributed mass and elasticity.

Composite Materials and Design

Introduction to composites, concept of reinforcement, strengthening mechanisms, fibrous reinforcement, matrix materials, micro-mechanical aspects of composites, manufacturing method, composite production design method-design of tensile members, pressure vessels, storage tank, and other chemical process equipment made of FRP, design of joints, damage of composites by impact, FRP grid, recent development in manufacturing of composites and technologies.

B. Tech. (ECE Engg & AME) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware - I	
	Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Aircraft Aerodynamics, Structures and Systems (Basic Instrument)	
	Electronic Fundamental	
	Materials and Hardware - II	
	Maintenance Practices (Non Destructive Technique & Aircraft Handling)	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-I)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-I)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-II)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-II)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Applied Mathematics	
	Physics	

Semester -VII

Code No.	Papers	Credit
Theory Papers		
	Operation Research	
	Control System	
	Digital Communication	
	Microelectronics Circuits	
	Modern Communication Technologies	
	Multimedia Computing	

Semester -VIII

Code No.	Papers	Credit
Theory Papers		
	Satellite Communication	
	Communication Networks II	
	Digital Signal Processing	
	Analog and Digital VLSI Design	
	Information Theory & Coding	
	Telecommunication Switching System Networks	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section –1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules1937 &CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.
- 3. Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

1. Fundamentals of structural systems.
2. Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II ELECTRICAL FUNDAMENTALS

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section – 2 & AAC: MODIFICATIONS, Rule – 52, Series M Part I, 1 of 1996 – Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section – 2 & AAC: Licensing: Rule – 17, 19, 61, Series L Part 11 to XV, 7 of 2000 – Issue of certificate of Competency, 8 of 2000 – Refresher training for AME / APP.5 of 1998 – Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section – 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule – 25, 25A, 25B, Series H – Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD AND TRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non ferrous materials used in aircraft, heat treatment and application of non ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems **(Basic Computer Structure, Micro Processor and** **Software Management Control)**

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure **and Systems**

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

Aircraft Aerodynamics, Structures and Systems (Basic Instrument)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms: Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting.

Electronic Fundamental

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System

ECAM – Electronic Centralized Aircraft Monitoring

EFIS – Electronic Flight Instrument System

EICAS – Engine Indication and Crew Alerting System

FBW – Fly by Wire
FMS – Flight Management System
GPS – Global Positioning System
IRS – Inertial Reference System
TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

Materials and Hardware - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and beaming/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

Sem-IV

Aircraft Aerodynamics Structures and Systems **(Electrical Part-I)**

Electrical Power (ATA 24) (Generation): Batteries Installation and Operation; DC Power Generation; Voltage regulation. **Introduction to primary and secondary cells**, Lead acid battery construction, Batteries charging in shop & aircraft (constant current , constant voltage method), Internal resistance & Rating of batteries, Capacity / Load testing, Chemical action on Ni-cad batteries, Charging procedure on Ni-cad batteries, Lower & upper nut torque check procedure, Emf induced in a rotating loop & production of direct current, Identification & function of various parts like yoke, field magnets, armature, commutator & brushes, Types of DC generators, Maintenance procedure of generators, Types of voltage regulators, Alternator construction, Frequency wild alternator, Switches, Relays, Circuit breaker.

Aircraft Aerodynamics Structures and Systems **(Instrument Part-I)**

Instrument Systems (ATA 31): Classification; Atmosphere; Terminology; Pressure measuring devices and systems; Pitot static systems; Altimeters; Vertical speed indicators; Airspeed indicators; Mach meters; Altitude reporting/ alerting systems; Air data computers; Instrument pneumatic systems; Direct reading pressure and temperature gauges; Temperature indicating systems; Fuel quantity indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems; Compass systems; Flight Data Recording Systems; Electronic Flight instrument Systems; Instrument warning systems including master warning systems. Vibration measurement and indication.

On board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Aircraft Aerodynamics Structures and Systems **(Communication/ Navigation Part-I)**

Communication (ATA 23): Fundamental of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; working principles of following systems:

- Emergency Locator Transmitters;
- Flight Management Systems;
- Global Positioning System (GPS),
- Global Navigation
- Satellite Systems (GNSS);
- Inertial Navigation System;
- Traffic Alert and Collision Avoidance System (TCAS);

Equipment and Furnishings (ATA 25): Electronic emergency equipment requirements; Cabin entertainment equipment.

Sem-V

Aircraft Aerodynamics Structures and Systems **(Electrical Part-II)**

5 Electrical Power (Distribution): Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Aircraft Aerodynamics Structures and Systems **(Instrument Part-II)**

Auto flight (ATA 22): Fundamental of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface; Autothrottle systems; Automatic Landing System: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.

Flight Controls (ATA 27): Primary Control; aileron, elevator, rudder, spoiler; Trim Control; Active load control; High lift device; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks; Stall protection system. **b)** System operation: electrical, fly by wire.

Aircraft Aerodynamics Structures and Systems **(Communication/ Navigation Part-II)**

Navigation (ATA 34): Very High Frequency (VHF) communication; High Frequency (HF) communication; Audio; Cockpit Voice Recorder; Very High Frequency omni directional range (VOR); Automatic Direction Finding (ADF); Instrument Landing System (ILS); Microwave Landing System (MLS); Flight Director systems; Distance Measuring Equipment (DME); Doppler navigation; Area navigation, RNAV systems; Weather avoidance radar; Radio altimeter; Air Traffic Control transponder, secondary surveillance radar; ARINC communication and reporting.

Sem-VI

Principles of Management

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Cauchy's root test, D'Alembert's Ratio Test, Gauss test, Demoiivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable. Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems. 2

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules
Chemical Compounds
States: Solid, Liquid and Gaseous
Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler effect.

Sem-VII **Operation Research**

Introduction to operations research; dynamic programming; network models- including CPM and PERT; probability distributions; inventory models; queuing systems; decision making – under certainty, risk, and uncertainty; games theory; simulation techniques, systems reliability.

Control System

Mathematical models of physical systems, feedback characteristics of control system components, time response analysis, stability, frequency response, state space analysis, compensation.

Digital Communication

Introduction, the modeling and characterization of information sources, algorithms for source coding and encoding of analog output sources; Information transmission through AWGN Channels using digital modulation methods and BER estimation Digital communication through band limited Gaussian noise channels; Channel coding and decoding; Wireless communication channels its characterization And modulation schemes for such channels; emerging trends in the above field.

Microelectronic Circuits

Basic single and two transistor amplifier configurations; current mirrors & current sources; Active loads; biasing in discrete and integrated circuit amplifiers; voltage sources and voltage References; differential and multistage amplifiers; frequency response of amplifiers; Frequency compensation; output stages and power amplifiers; filters and tuned amplifiers; signal sources and communication circuits etc, illustrative example of analog integrated circuits. The course will emphasize MOS/CMOS and bipolar transistor circuits. Computer simulation exercise using SPICE and other software packages will be prescribed.

Modern Communication Technologies

Modern communication system overview, Digital modulation techniques, channel capacity & coding, Digital link improvement techniques, digital receiver design and performance analysis, Wireless communication system: wireless channel models and link improvement techniques, multiple access schemes. Basic concept of mobile network, Optical Communication System Transmitters, receivers and other optical Communication subsystem, Optical wireless system

Multimedia Computing

Introduction to multimedia; Media & data Streams; Image, video & audio file formats; Image & video processing, synthesis of sound signal; Image coding & compression, video & audio codecs, low bit rate video telephony; Audio-visual integration, lip reading, faces animation; Augmented reality; Multimedia search services, content based image & video indexing; Access to multimedia, human-machine interfaces, spoken language interface; algorithm vs. Architecture based approaches, multimedia processors, performance quantification; Case studies, vision 2010.

Sem-VIII Satellite Communication

Review of microwave communications and LOS systems; the various satellite orbits like GEO, MEO, LEO; the satellite link analysis and design; the communication transponder system like INSAT, INELSAT etc. the earth segment and earth station engineering; the transmission of analog and digital signals through satellite and various modulation techniques employed the multiple access techniques like FDMA, TDMA, CDMA, DADMA, etc; the INSAT program; salient features of INSAT- systems and services offered; satellite service offered by INTELSAT, INMARSAT and feature satellites like IRIDIUM etc; future trend in satellite communications.

Communication Networks II

Packet switching and circuit switching; layered network architecture(OSI model), point to point protocols and link:physical layer, error detection and correction, ARQ retransmission strategy, framing, X.25 standard , queuing theory and delay analysis:Little's theorem, analytical treatment of M/M/1 and M/M/m queuing systems, simulation of queuing system, delay analysis for ARQ system, multi-access protocol sand techniques :Aloha systems, CSMA, IEEE-802 standards, routing and flow control. TCP/IP protocols, ISDN, ATM, network security, design of a LAN system with commercially available functional units. Wireless LAN: adhoc network, security issues.

Digital Signal Processing

Introduction; design of analog filters; design of digital filters(IIR and FIR); structures for the realization of digital filters; random signals and random processes; linear estimation and prediction; wiener filters; DSP Processor architecture; DSP algorithms for different applications.

Analog and Digital VLSI Design

Physics and models of MOS transistors, basic IC building blocks, MOS operational amplifiers; Analog system design applications; Digital circuits- MOS & CMOS inverters, logic gates, PLA and storage circuits etc; Introduction to analog and digital VLSI design; CAD for IC design and CAD applications in circuit simulation and layout generation.

Information Theory & Coding

Random variables and random processes; Information source and source coding theorem, Kraft inequality, Shanno-Franno codes, Huffman codes, Arithmetic codes, Lempel-Ziv-Welch algorithm, universal source codes; channel capacity; noisy channel coding theorem for discrete memoryless channel ;channel capacity with feedback; continuous and Gaussian channels; error control coding; linear block codes and their properties , hard decision decoding, convolution codes and the viterbi decoding algorithm, iterative decoding; turbo codes and low density parity check codes; rate distortion theory: rate distortion function, Random source codes; joint source channel coding and the separation theorem; cryptography: basic concepts on cryptography and cryptoanalysis, security issues; private key encryption algorithm- stream ciphers, block ciphers, Shannon's theory; introduction to number theory-modular arithmetic .exponentiation and discrete logarithms in Galois field; public key encryption algorithm-Diffie-Hellman public key distribution scheme, public key cryptosystem: message authentication, hashing function, digital signatures.

Telecommunication Switching Systems Networks

Introduction, electromechanical switching, pulse dialing and DTMF dialing, stored program control, space division switching, speech digitization and transmission, time division switching, fundamentals of traffic engineering, telephone networks, signaling, data networks, layered architecture and protocols, LANs, packet switching networks, TCP/IP, ISDN, ATM networks.

B. Sc. (Mechanical) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware - I	
	Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Aircraft Aerodynamics, Structures and Systems (Basic Instrument)	
	Electronic Fundamental	
	Materials and Hardware - II	
	Maintenance Practices (Non Destructive Technique & Aircraft Handling)	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-I)	
	Turbine Aeroplane Aerodynamics, Structure (Part-I) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Gas Turbine Engine, Piston Engine & Propeller (Part-II)	
	Turbine Aeroplane Aerodynamics, Structure (Part-II) and Systems & Piston Aeroplane Aerodynamics Structures and systems (Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Applied Mathematics	
	Physics	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section –1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III, DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules1937 &CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.
- 3. Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

- 1. Fundamentals of structural systems.**
- 2. Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.**

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II

ELECTRICAL FUNDAMENTALS

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section – 2 & AAC: MODIFICATIONS, Rule – 52, Series M Part I, 1 of 1996 – Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section – 2 & AAC: Licensing: Rule – 17, 19, 61, Series L Part 11 to XV, 7 of 2000 – Issue of certificate of Competency, 8 of 2000 – Refresher training for AME / APP.5 of 1998 – Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section – 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule – 25, 25A, 25B, Series H – Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD ANDTRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non Ferrous materials used in aircraft, heat treatment and application of non Ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems **(Basic Computer Structure, Micro Processor and** **Software Management Control)**

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure and Systems

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

Aircraft Aerodynamics, Structures and Systems (Basic Instrument)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms: Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting.

Electronic Fundamental

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System

ECAM – Electronic Centralized Aircraft Monitoring

EFIS – Electronic Flight Instrument System

EICAS – Engine Indication and Crew Alerting System

FBW – Fly by Wire

FMS – Flight Management System

GPS – Global Positioning System

IRS – Inertial Reference System

TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

MATERIALS AND HARDWARE - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and beveling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

Sem-IV

Gas Turbine Engine, Piston Engine & Propeller

(Part-I)

Fundamentals 1 2: Mechanical, thermal and volumetric efficiencies; Operating principles — 2 stroke, 4 stroke, Otto and Diesel; Piston displacement and compression ratio; Engine configuration and firing order.

Engine Performance 1 2: Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.

Engine Construction 1 2: Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; Propeller reduction gearboxes.

Engine Fuel Systems, Carburettors 1 2: Types, construction and principles of operation; Icing and heating.

Fuel injection systems 1 2: Types, construction and principles of operation.

Electronic engine control 1 2: Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.

Starting and Ignition Systems 1 2: Starting systems, pre-heat systems; Magneto types, construction and principles of operation; Ignition harnesses, spark plugs; Low and high tension systems.

Induction, Exhaust and Cooling Systems 1 2: Construction and operation of: induction systems, including alternate air systems; Exhaust systems, engine cooling systems — air and liquid.

Supercharging/Turbo charging 1 2: Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/turbo charging systems; System terminology; Control systems; System protection.

Lubricants and Fuels 1 2: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems 1 2: System operation/lay-out and components.

Engine Indication Systems: Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.

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.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer.

Engine Storage and Preservation: Preservation and depreservation for the engine and accessories/ systems.

PROPELLER

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.

Propeller Construction 1 2: 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.

Propeller Pitch Control: Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Over speed protection.

Propeller Synchronizing: Synchronizing and synchrophasing equipment.

Propeller Ice Protection: Fluid and electrical de-icing equipment

Propeller Maintenance: Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, Impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.

Propeller Storage and Preservation: Propeller preservation and depreservation.

Turbine Aero plane Aerodynamics, Structure (Part-I) **and Systems & Piston Aero plane Aerodynamics** **Structures and systems (Part-I)**

Physics of the Atmosphere: International Standard Atmosphere (ISA), application to aerodynamics.

Aerodynamics: Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Aeroplane Aerodynamics and Flight Controls Operation and effect of: Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stabilators, variable incidence stabilizers and canards; yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flapersons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;

High Speed Flight: Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.

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; Lightning strike protection provision.

b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, 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.

Fuselage: Construction and pressurization sealing; Wing, stabilizer, pylon and undercarriage attachments; Seat installation and cargo loading system; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.

Wings: Construction; Fuel storage, Landing gear, pylon control surface and high lift/drag attachments.

Stabilizers: Construction; Control surface attachment.

Flight Control Surfaces: Construction and attachment; Balancing – mass and aerodynamic.

Nacelles/Pylons: Construction; Firewalls; Engine mounts

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 locks systems; Balancing and rigging; Stall protection/warning system.

Sem-V

Gas Turbine Engine, Piston Engine & Propeller

(Part-II)

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.

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.

Inlet: Compressor inlet ducts, Effects of various inlet configurations; ice protection.

Compressors: Axial and centrifugal types; Constructional feature and operating principles and applications; Fan balancing, Operation; Causes and effect of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ration.

Combustion Section: Constructional features and principles of operation.

Turbine Section: Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes; Causes and effect of turbine blade stress and creep.

Exhaust: Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.

Bearings and Seals: Constructional features and principles of operation.

Lubricants and Fuels: Properties and specifications; Fuel additives; Safety precautions.

Lubrication Systems: System operation/lay-out and components.

Fuel Systems: Operation of engine control and fuel metering systems including electronic engine control (FADEC); System lay-out and components.

Air Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Starting and Ignition Systems: Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

Engine Indication Systems: Exhaust Gas Temperature/Interstage Turbine, Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication; Torque; Power.

Power Augmentation Systems: Operation and applications; Water injection, water methanol; Afterburner systems.

Turbo-prop Engines: Gas coupled/free turbine and gear coupled turbines; Reduction gears; integrated engine and propeller controls; Overspeed safety devices.

Turbo-shaft engines: Arrangements, drive systems, reduction gearing, couplings, control systems.

Auxiliary Power Units (APUs): Purpose, operation, protective systems

Power plant Installation: Configuration of firewalls, cowlings, acoustic panels, and engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.

Fire Protection Systems: Operation of detection and extinguishing systems.

Engine Monitoring and Ground Operation: Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring;

Engine Storage and Preservation – 2: Preservation and depreservation for the engine and accessories/systems.

Turbine Aero plane Aerodynamics, Structure (Part-II) **and Piston Aero plane Aerodynamics** **Structures and systems (Part-II)**

Air Conditioning and Cabin Pressurization and *Air supply*: Pressurization and air conditioning systems; Cabin pressure controllers, protection and warning devices. Sources of air supply including engine bleed, APU and ground cart.

Air Conditioning: Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.

Pressurization: Pressurization systems; Control and indication including control and safety valves; Cabin pressure controllers.

Safety and warning devices: Protection and warning devices.

Instruments/Avionic Systems and Instrument Systems: Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn co-ordinator Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Other aircraft system indication.

Avionic Systems: Fundamentals of system lay-outs and operation of; Auto Flight (ATA 22); Communications (ATA 23) Navigation Systems (ATA 34).

Electrical Power (ATA 24): Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Equipment and Furnishings (ATA 25): Emergency equipment requirements; Seats, harnesses and belts. Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.

Fire Protection (ATA 26): Fire and smoke detection and warning systems .Fire extinguishing systems; System tests.

Fuel Systems (ATA 28): System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refueling and defueling; Longitudinal balance fuel systems.

Hydraulic Power (ATA 29): System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.

Ice and Rain Protection (ATA 30): Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, pneumatic and chemical; Rain repellent and removal; Probe and drain heating.

Landing Gear (ATA 32) 2 3: Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and auto braking; Tyres; Steering.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Oxygen (ATA 35): System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings.

Pneumatic/Vacuum (ATA 36): System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure Control; Distribution; Indications and warnings; Interfaces with other systems.

Water/Waste (ATA 38): Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.

On Board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Sem-VI

Principles of Management

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Cauchy's root test, D'Alembert's Ratio Test, Gauss test, Demoivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable. Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems. 2

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition.

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules, Chemical Compounds. States: Solid, Liquid and Gaseous, Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler Effect.

B. Sc. (Electronics) Syllabus

Semester -I

Code No.	Papers	Credit
Theory Papers		
	Maintenance Practices (Workshop Technology)	
	Aviation Legislation Part-I	
	Maintenance Practices (Engineering Drawing)	
	Basic Aerodynamics	
	Human Factors	

Semester -II

Code No.	Papers	Credit
Theory Papers		
	Electrical Fundamentals	
	Aviation Legislation Part-II	
	Materials and Hardware	
	Digital Techniques Electronic Instrument Systems (Basic Computer)	
	Turbine Aeroplane Aerodynamics, Structure and Systems	

Semester -III

Code No.	Papers	Credit
Theory Papers		
	Propulsion	
	Electronic Fundamental	
	Maintenance Practices (Hardware)	
	Maintenance Practices	

Semester -IV

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-I)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-I)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-I)	

Semester -V

Code No.	Papers	Credit
Theory Papers		
	Aircraft Aerodynamics Structures and Systems (Electrical Part-II)	
	Aircraft Aerodynamics Structures and Systems (Instrument Part-II)	
	Aircraft Aerodynamics Structures and Systems (Communication/Navigation Part-II)	

Semester -VI

Code No.	Papers	Credit
Theory Papers		
	Principles of Management	
	Mathematics	
	Physics	

Sem-I

Maintenance Practices (Workshop Technology)

Safety Precautions-Aircraft and Workshop: Aspects of safe working practices including precautions to take when working with electricity, gasses 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.

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.

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.

Avionic General Test Equipment: Operation, function and use of avionic general test equipment.

Fits and Clearances: Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.

Bearings: Purpose of bearings, loads, material, construction; Types of bearings and their application.

Springs: Types of springs, materials, characteristics and applications.

Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.

Material handling and Sheet Metal: Marking out and calculation for bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.

Welding, Brazing, Soldering and Bonding: Soldering methods, inspection of soldered joints. Welding and brazing methods, Inspection of welded joints and brazed joints. Bonding methods and inspection of bonded joints.

Aviation Legislation Part-I

The A/C Act. 1934: Introduction: Detailed Discussion of section –1, 2, 3, 4, 5, 5A, 6, 7, 8, 8A, 8B, 8C, 9, 9A, 9C, 10, 11, 11A, 11B, 12, 14A.

The A/C Rules 1937: Rule 1 – Short title and extent. Rule 3 – Definition and interpretation.

The A/C Rules, 1937 & CAR Section – 2 AAC: Nationality and registration marking of aircraft Rule – 2, 5, 14, 30, 31, 32, 33, 35, 36, 37, 37S Series – F Part – I

The A/C Rules 1937 & CAR section-2 AAC: Approval of organizations. Rule – 133B, 133C, 154, 155, 155 A. Series-E Part – I to IX & CAR 21, CAR 145, 2 of 2001 – Accountable managers, 4 of 1998 Approval of foreign repair organization.

The A/C rules 1937: Rule 8 – carriage of arms, explosives & Dangerous goods, Rule 10 – Mails, Rule 11 – Aerodromes, Rule 12 – Prohibited Areas, Rule 13 – Photographs at aero plane and from a/c in flight, Rule 13 A – Carriage of photographic apparatus in a/c, Rule 18 – Invention of flights in contravention of the rules, Rule 20 – Set and rule not applicable to gliders & kites, Rule 26 – Dropping of articles & decent by parachute, Rule 29 B – Prohibition on use of portable electronic devices, Rule 38 A – Carriage of operating crew.

CAR Section – 2 & the A/c Rules 1937: RESPONSIBILITIES OF OWNER/OPERATOR AND AIR WORTHINESS DIRECTORATE: Series – A Part – I, II, III DOCUMENTS TO BE CARRIED ON BOARD A/C: Rule – 7, 7B, Series B Part- I, II, Series X Part VII.

The A/C Rules 1937 & CAR Section – 2 AAC: DEFECTS, RECORDING, REPORTING INVESTIGATION ANALYSIS AND RECTIFICATION: Rule –56, 59, 59A, Series – C Part - I to V 5 of 2001 – Engineering Statistics Report.

The A/C Rules 1937 CAR Section –2 AAC: APPROVED MAINTENANCE PROGRAM Rule 60 Series – D Part – I to VI, Series – A Part – IV Oversight Program of 2000 – Airworthiness Surveillance, 2 of 1995 – Extension to the approved lives of component and inspection schedules.

The A/C Rules 1937 CAR Section –2 AAC: TYPE – CERTIFICATE Rule: 49, 49A, 49B 49C, 49D, 62, Series – F Part – II, XI, X, Series – X Part – IX, 7 of 1998 – Guidelines for procuring Parts manufactured by PMA Holders.

The A/C Rules 1937 & CAR Section -2: CERTIFICATION OF AIRWORTHINESS Rule: 15, 50,50A, 55, 62 (Sub rule D) Series F Part – III, V.

CAR Section – 2 AAC: CONTINUED AIRWORTHINESS & MANNER OF CERTIFICATION OF AIRCRAFT, Series – F Part – VII, VIII, IX, X, XI, XVII, 4 of 2000 – Maintenance of ageing A/C.

The A/C Rules1937 &CAR Section – 2: INSPECTION AND AIRWORTHINESS REQUIREMENTS OF WOODEN AIRCRAFT GLIDES, MICRO LIGHT AIRCRAFT AND HOT AIR BALOON: Series F Part – XII, XIII, XIV, XV

The A/C Rules 1937 & CAR Section – 2: FLIGHT MANUAL, Rule – 51, Series – F Part5 XVI

CAR Section – 2: AGE OF A/C IMPORTED INTO INDIA AND PROCEDURE FOR IMPORT OF A/C SPARES, EQUIPMENTS ETC. Series F – XV & XXI

The A/C Rules 1937: GENERAL: Rule 156 – Inspection, Rule 157 – fraudulent of documents, Rule 158 – Foreign Military Aircraft, Rule 158 A – Aircraft Registered in or belonging to Foreign state, Rule 159 – Obstruction of Authorized person, Rule 160 – General power to exempt, Rule 161 – Penalties.

Maintenance Practices (Engineering Drawing)

Engineering Drawings, Diagrams and Standards: Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerized presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including, ISO, An, MS, NAS and MIL; Wiring diagrams and schematic diagrams.

BASIC AERODYNAMICS

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.

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.

Flight Stability and Dynamics: Longitudinal, lateral and directional stability (active and passive).

Theory of Flight:

- 1. Aero plane Aerodynamics and Flight Controls:** Operation and effect of: roll control: ailerons and spoilers; pitch control: elevators, stipulators, Variable incidence stabilizers and canards; Yaw control, rudder limiters; Control using elevons, ruddervators; Height lift devices; slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface blas.
- 2. High Speed Flight:** Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.
- 3. Rotary Wing Aerodynamics:** Terminology; Operation and effect of cyclic, collective and anti-torque controls.

Structures — General Concepts:

- 1. Fundamentals of structural systems.**
- 2. Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.**

Human Factors

General: The need to take human factors into account; Incidents attributable to human factors/human error. Murphy's Law.

Human Performance and Limitations: Vision; Hearing; Information Processing; Attention and perception; Memory; Claustrophobia and physical access.

Social Psychology: Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.

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.

Physical Environment: Noise and fumes; Illumination; Climate and temperature; Motion and vibration; Working environment.

Tasks: Physical work; Repetitive tasks; Visual inspection; Complex systems.

Communication: Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.

Human Error: Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e. accidents); Avoiding and managing errors.

Hazards in the Workplace: Recognizing and avoiding hazards; Dealing with emergencies.

Sem -II

Aviation Legislation Part-II

The A/C Rules 1937 & CAR Section – 2 & AAC: MODIFICATIONS, Rule – 52, Series M Part I, 1 of 1996 – Related with modification 1 of 1997

The A/C Rules 1937 & CAR Section – 2 & AAC: Licensing: Rule – 17, 19, 61, Series L Part 11 to XV, 7 of 2000 – Issue of certificate of Competency, 8 of 2000 – Refresher training for AME / APP.5 of 1998 – Grant of approval to foreign AME

The A/C Rules 1937 & CAR Section – 2: FUELING AND SMOKING IN A / C HOUSING OF A / C, Rule – 25, 25A, 25B, Series H – Part I, II, III.

The A/C Rules 1937 & CAR Section – 2 & AAC: Rules – 9, 57, Series I Part I to VIII, Series X Part – III, Series R Part – I to VI, Series O Part I, II, III, IV, V, IX, XI, XII, 6 of 2000 – Handling of ESDS equipments.

The A/C Rules 1937 & CAR Section – 2: OPERATIONAL MANUAL, ROUTE GUIDE, DUTIES OF PIC: Rule – 140B, 140C, 141, Series O Part – X.

The A/C Rules 1937 & CAR Section – 2: CARRIAGE OF CABIN ATTNDANT AND EXIT ROW SITTING, Rule – 38B, Series O Part – XII.

The A/C Rules 1937 & CAR Section – 2 & AAC: Airworthiness requirement and maintenance requirement for category II and III A operations: Series – O, 1 of 1999.

The A/C Rules 1937 & CAR Section – 2: STORAGE CONDITION AND DISTRIBUTION OF AIRCRAFT PARTS: Rule – 53, 53A, 54, Series – S Part I and II

The A/C Rules 1937 & CAR Section – 2: Airworthiness maintenance and approval requirement for ETOPS, Series – O part VIII.

The A/C Rules 1937 & CAR Section – 2: TESTING FLIGHT: Series T Part – I & II.

The A/C Rules 1937 & CAR Section – 2: WEIGHT AND BALANCE OF AIRCRAFT & LOAD AND TRIM SHEET, Rule – 58, Series - X Part – II, Series – F Part – XXII.

The A/C Rules 1937 & CAR Section – 2: LOG BOOKS AND LOGS, Rule – 67. 67A, Series – X Part – VI

The A/C Rules 1937 & CAR Section – 2: Use of furnishing material in A/C. concessions and individual authorized to taxi aircraft: On behalf of rule 133A, Series X Part – IV, V, VIII.

The A/C Rules 1937 & CAR Section – 2 & AAC: INVESTIGATIONS AND ACCIDENTS, Rule – 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77B, 77C, 77D, 4 of 2003 – Return to service of a/c items recovered from a/c involved in incident accident.

AAC: Violation of CAR, Operation of private a/c, Banner towing in operation, Good maintenance practices, 11 of 1995, 6 of 1995, 3 of 2001, 3 of 2000

ELECTRICAL FUNDAMENTALS

Electron Theory: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.

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.

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.

Generation of Electricity: Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.

DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.

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.

Resistance/Resistor: Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge. Positive and negative temperature coefficient conductance; Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge.

Power: Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.

Capacitance/Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, Number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.

DC Motor/Generator: Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.

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/3phase principles;

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.

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; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.

Filters: Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.

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; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.

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.

Materials and Hardware-I

Aircraft Materials — Ferrous: Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels; Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous: Characteristics, properties and identification of common non Ferrous materials used in aircraft, heat treatment and application of non Ferrous materials. Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Composite and Non-Metallic: Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents. The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion: Chemical fundamentals; Formation by, galvanic action process, microbiological, stress; Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic: Bonding practices; Environmental conditions, Inspection methods.

Digital Techniques Electronic Instrument Systems (Basic Computer Structure, Micro Processor and Software Management Control)

Basic Computer Structure: 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). Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multi address instruction words; Memory associated terms; Operation, advantages and disadvantages of the various data storage systems.

Microprocessors: Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.

Software Management Control: Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programs.

Turbine Aero plane Aerodynamics, Structure and Systems

Airframe Structures — General Concepts:

- 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

Flight Controls (ATA 27):

- Primary controls: aileron, elevator and rudder.
- Trim tabs;
- High lift devices;
- System operation: manual;
- Gust locks;
- Balancing and rigging;
- Stall warning system.

SEM-III

PROPULSION

Turbine Engines: Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines. Electronic Engine Control and Fuel Metering systems (FADEC).

Engine Indicating Systems: Exhaust Gas Temperature \ Inter stage Turbine temperature systems, Engine Speed, Engine thrust Indication, Engine pressure Ratio, Engine Turbine Discharge Pressure or Jet Pipe Pressure Systems, Oil Pressure and Temperature, Fuel Pressure, Temperature and flow, Manifold Pressure, Engine Torque, Propeller speed.

Aircraft Aerodynamics, Structures and Systems (Basic Instrument)

Electronic Instrument Systems: Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms: Understanding of the following Terms:- Open and Close Loop systems, feedback, follow up, Analogue Transducers, Principle of Operation and Use of following Synchro System components \ Features:- Resolvers, Differential, control and torque, transformers, Inductances and Capacitance Transmitters.

Understanding of the following Terms:- Servo mechanism, Null, Damping, Dead band, Construction operation and use of the following Synchro system components : Resolvers, Differential, control and torque, E & I Transformer, Inductance Transmitters, Capacitance Transmitters, Synchronous Transmitters, Servo Mechanism Defects, Reversal of Synchro leads, Hunting

Electronic Fundamental

Transistors:

- a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.
- b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configuration; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilization; multistage circuit principles: cascades, push-pull, oscillators, multi-vibrators, flip-flop circuits.

Integrated Circuits:

Description and operation of logic circuits and linear circuits/operational amplifiers.

Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, differentiator, voltage follower, comparator; Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct; Advantages and disadvantages of positive and negative feedback.

Printed Circuit Boards: Description and use of printed circuit boards.

Numbering Systems: Numbering systems: binary, octal and hexadecimal; Demonstration of conversation between the decimal and binary, octal and hexadecimal systems and vice versa.

Data Conversion: Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analog converters, inputs and outputs, limitations of various types.

Data Buses: Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.

Logic Circuits: Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams. Interpretation of logic diagrams.

Integrated Circuits: Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.

Multiplexing: Operation, application and identification in logic diagrams of multiplexers and de-multiplexers.

Fiber Optics: Advantages and disadvantages of fiber optic data transmission over electrical wire propagation; Fiber optic data bus; Fiber optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fiber optics in aircraft systems.

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.

Electrostatic Sensitive Devices: Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.

Electromagnetic Environment: Influence of the following phenomena on maintenance practices from electronic system; EMC – Electromagnetic Compatibility, EMI – Electromagnetic Interference, HIRF – High Intensity Radiated Field, Lightning/lightning protection.

Typical Electronic/Digital Aircraft Systems:

ACARS – ARINC Communication and Addressing and Reporting System

ECAM – Electronic Centralized Aircraft Monitoring

EFIS – Electronic Flight Instrument System

EICAS – Engine Indication and Crew Alerting System

FBW – Fly by Wire

FMS – Flight Management System

GPS – Global Positioning System

IRS – Inertial Reference System

TCAS – Traffic Alert Collision Avoidance System

Note: Different manufacturers may use different terminology for similar systems.

Materials and Hardware - II

Fasteners & Screw threads: Screw nomenclature; Thread forms, dimensions and tolerances for standard threads used in aircraft; measuring screw threads.

Bolts, studs and screws: Bolt types: specification, identification and marking of aircraft bolts, international standards; Nut: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.

Locking devices: Tab and spring washers, locking plates, split pins, pal-nuts, wire locking. Quick release fasteners, keys, circlips, cotter pins.

Aircraft rivets: Types of solid and blind rivets: specifications and identification, heat treatment.

Pipes and Unions: Identification of, and types of rigid and flexible pipes and their connectors used in aircraft. Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

Control Cables: Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.

Electrical Cables and Connectors & 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. Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.

Riveting: Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.

Pipes and Hoses: Bending and beveling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.

Maintenance Practices (Non Destructive Technique & Aircraft Handling)

Aircraft Weight and Balance: Centre of Gravity/Balance limits calculation: use of relevant documents; Preparation of aircraft for weighting; Aircraft weighing.

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.

Disassembly, Inspection, Repair and Assembly Techniques: Types of defects and visual inspection techniques. Corrosion removal, assessment and reproduction. General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes. Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods. Disassembly and re-assembly techniques. Trouble shooting techniques.

Abnormal Events: Inspection following lightning strikes and HIRF penetration. Inspections following abnormal events such as heavy landings and flight through turbulence.

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

Sem-IV

Aircraft Aerodynamics Structures and Systems (Electrical Part-I)

Electrical Power (ATA 24) (Generation): Batteries Installation and Operation; DC Power Generation; Voltage regulation. **Introduction to primary and secondary cells,** Lead acid battery construction, Batteries charging in shop & aircraft (constant current , constant voltage method), Internal resistance & Rating of batteries, Capacity / Load testing, Chemical action on Ni-cad batteries, Charging procedure on Ni-cad batteries, Lower & upper nut torque check procedure, Emf induced in a rotating loop & production of direct current, Identification & function of various parts like yoke, field magnets, armature, commutator & brushes, Types of DC generators, Maintenance procedure of generators, Types of voltage regulators, Alternator construction, Frequency wild alternator, Switches, Relays, Circuit breaker.

Aircraft Aerodynamics Structures and Systems (Instrument Part-I)

Instrument Systems (ATA 31): Classification; Atmosphere; Terminology; Pressure measuring devices and systems; Pitot static systems; Altimeters; Vertical speed indicators; Airspeed indicators; Mach meters; Altitude reporting/ alerting systems; Air data computers; Instrument pneumatic systems; Direct reading pressure and temperature gauges; Temperature indicating systems; Fuel quantity indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems; Compass systems; Flight Data Recording Systems; Electronic Flight instrument Systems; Instrument warning systems including master warning systems. Vibration measurement and indication.

On board Maintenance Systems (ATA 45): Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).

Aircraft Aerodynamics Structures and Systems (Communication/ Navigation Part-I)

Communication (ATA 23): Fundamental of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; working principles of following systems:

- Emergency Locator Transmitters;
- Flight Management Systems;
- Global Positioning System (GPS),
- Global Navigation
- Satellite Systems (GNSS);

- Inertial Navigation System;
- Traffic Alert and Collision Avoidance System (TCAS);

Equipment and Furnishings (ATA 25): Electronic emergency equipment requirements; Cabin entertainment equipment.

Sem-V

Aircraft Aerodynamics Structures and Systems (Electrical Part-II)

5 Electrical Power (Distribution): Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.

Lights (ATA 33): External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.

Aircraft Aerodynamics Structures and Systems (Instrument Part-II)

Auto flight (ATA 22): Fundamental of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface; Autothrottle systems; Automatic Landing System: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.

Flight Controls (ATA 27): Primary Control; aileron, elevator, rudder, spoiler; Trim Control; Active load control; High lift device; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks; Stall protection system. **b)** System operation: electrical, fly by wire.

Aircraft Aerodynamics Structures and Systems (Communication / Navigation Part-II)

Navigation (ATA 34): Very High Frequency (VHF) communication; High Frequency (HF) communication; Audio; Cockpit Voice Recorder; Very High Frequency omni directional range (VOR); Automatic Direction Finding (ADF); Instrument Landing System (ILS); Microwave Landing System (MLS); Flight Director systems; Distance Measuring Equipment (DME); Doppler navigation; Area navigation, RNAV systems; Weather avoidance radar; Radio altimeter; Air Traffic Control transponder, secondary surveillance radar; ARINC communication and reporting.

Sem-VI

Principles of Management

Management Concepts, Management Thoughts, Planning, Decision Making, Organization, Delegation of Authority, Nature and Purpose of Staffing, Staffing-Selection Process & Techniques, Directing/Direction.

Reference:

Principles of Management by K. Anbuvelan

Applied Mathematics

Differential Calculus : Expansion by Maclaurin's and Taylor's series. Indeterminate forms. Functions of two variables, Limit - continuity, partial derivative, total derivative. Euler's theorem for homogenous functions; composite functions. Taylor's series for two independent variables maxima and minima for functions of two variables, errors and increments.

Tangents and Normals. Equations of tangents and normals, derivative of the length of arc (cartesian and polar co-ordinates), angle between radius vector and tangent at a point. Sub tangents and sub normals. Curvature: radius of curvature, approximate formula for curvature of beams, Newton's method of determining curvature, curve tracing, catenary, cycloid, astroid, cissoid, folium of descartes, etc.

Algebraic Aids : Convergence and Divergence of infinite series. Cauchy's root test, D'Alembert's Ratio Test, Gauss test, Demoiivre's theorem, separation of Trigonometric, Hyperbolic and logarithmic functions into real and imaginary parts

Analytical Geometry of three dimensions : Equation of a cone, with vertex at origin. Right circular cone: Equation of right circular cone. Equation of cylinder and right circular cylinder. Equation of central conicoids, standard surfaces of revolution.

Multiple Integrals : Evaluation of double and triple integrals : double integrals, rectangular and polar co-ordinates, change of order of integration, change of variable. Triple integrals. Surface and volumes of revolution, centroids of arcs, plane areas, Pappus theorems.

Matrices : Vectors, linear dependence of vectors, rank of a matrix, linearly independent vectors of a matrix, characteristics of vectors and characteristics roots of a matrix, Cayley- Hamilton theorem, Inverse of a matrix, diagonalization of a matrix.

Applied Mechanics : Statics : Vector function, differentiation and line integral. Force and moment, parallel forces, couple, resultant of co-planar and non co-planar force systems and their equilibrium

Friction : Frictional phenomenon, Types of friction, Dry Friction, Mechanism of Friction, Friction on inclined planes, Coefficient and angle of friction, angle of repose, laws of friction, belt friction, simple problems.

Virtual Work: Principle of Virtual Work, conditions for stability of equilibrium, application to simple problems. 2

Vectorial Dynamics: Kinetics and Kinematics, velocity and acceleration as derivatives of a vector. Tangential and normal components, Radial and Transverse components, work, power, energy, momentum, moment of momentum. Impulse, Impulsive motion, impact, direct and oblique, angular momentum and energy of rotation, centripetal force, simple problems.

Mechanical Vibrations: Vibrations, free, damped and forced. Simple pendulum and compound pendulum.

Text Books:

1. B S Grewal, Engineering Mathematics, Prentice Hall, India
2. J S Bindra and K S Gill, A text book of Applied Mathematics, S K Kataria & Sons
3. F P Beer and E R Johnston, Vector Mechanics for Engineers, Tata McGrawhill, 1996

Reference Books:

1. Frank Ayres, Matrices, Schaum Series
2. J L Merriam and L G Kraige, Engineering Mechanics, John Willy
3. D E Christie, Vector Mechanics, McGrawhill, 2nd Edition.

Physics

Matter

Nature of Matter: The Chemical elements, Structure of atoms, Molecules, Chemical Compounds. States: Solid, Liquid and Gaseous, Changes between states.

Mechanics

Statics

Forces, moments and couples, representation as vectors, Centre of Gravity, Elements of theory of stress, strain and elasticity: tension compression, shear and torsion. Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).

Kinetics

Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.

Dynamics

Mass, Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency; Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).

Fluid dynamics

Specific gravity and density; Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.

Thermodynamics

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.

Optics (Light)

Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.

Wave Motion and Sound

Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler effect.