

SINGHANIA UNIVERSITY

B.TECH – AERONAUTICAL ENGINEERING (Avionics)

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DETAILED SYLLABUS

SEMESTER-I

Paper-I

Workshop Technology (BTAEN-101)

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.

Paper-II

Aviation Legislation Part-I (BTAEN-102)

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 Part 5 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.

Paper-III

Engineering Drawing (BTAEN 103)

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.

Paper-IV
Basic Aerodynamics (BTAEN 104)

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.

Paper-V
Human Factor (BTAEN 105)

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.

SEMESTER-II

Paper-I
Electrical Fundamentals (BTAEN-201)

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

a)

Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge.

b)

- 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 polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.

Paper-II

Aviation Legislation Part-II (BTAEN-202)

The A/C Rules 1937 & CAR Section – 2 & AAC

The A/C Rules vol. I and II

Civil Aviation Requirement Vol. II (Series L to X)

The A/C Rules 1937 & CAR Section – 2 & AAC

CAR 21, CAR M, CAR 147, CAR 66

Paper-III

Aircraft Material (BTAEN-203)

Aircraft Materials — Ferrous

- a) Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloys steels;
- b) Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

Aircraft Materials — Non-Ferrous

- a) Characteristics, properties and identification of common non Ferrous materials used in aircraft heat treatment and application of non Ferrous materials .
- b) Testing of non ferrous materials for hardness, tensile strength, fatigue strength and impact resistance

Aircraft Materials — Composite and Non-Metallic

- a) Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealants and bonding agents.
- b) The detection of defects in composite material. Repair of composite and non-metallic material.

Corrosion

- a) Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;
- b) Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.

Composite and non-metallic

- Bonding practices;
- Environmental conditions
- Inspection methods

Paper-IV

Computer Fundamentals (BTAEN-204)

Basic Computer Structure

- a) Computer terminology (including bit, byte, software, hardware, CPU, IC and various memory devices such as RAM, ROM, PROM); Computer technology (as applied in aircraft systems).
- b) Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and 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.

Paper-V
Aircraft & Components (BTAEN-205)

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

SEMESTER-III

Paper-I
Propulsion (BTAEN-301)

Turbine Engines

- a) Constructional arrangement and Operation of Turbojet, Turbo fan, Turbo shaft and Turbo Propeller Engines.

- b) 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.

Paper-II
Basic Aircraft Instruments (BTAEN-302)

Electronic Instrument Systems

Typical systems arrangements and cockpit layout of electronic instrument systems.

Servomechanisms

- a) 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.
- b) 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.

Paper-III
Electronics Fundamentals & Digital Technique (BTAEN-303)

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, multivibrators, flip-flop circuits.

Integrated Circuits

- a) Description and operation of logic circuits and linear circuits/operational amplifiers.
- b) 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

- a) Identification of common logic gate symbols, tables and equivalent circuits;
Applications used for aircraft systems, schematic diagrams.
- b) 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 for electronic systems;
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.

Paper-IV Aircraft Hardware (BTAEN-304)

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

- a) Identification of, and types of rigid and flexible pipes and their connectors used in aircraft.
- b) Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.

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.

SEMESTER-IV

Paper-I

Aircraft Electrical System-I (BTAEN-401)

Electrical Power (ATA 24) (Generation)

Batteries Installation and Operation; DC Power Generation; Voltage regulation.

Paper-II

Aircraft Instrument System-I (BTAEN-402)

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).

Paper-III

Aircraft Radio Communication/Navigation-I (BTAEN-403)

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.

SEMESTER-V

Paper-I

Aircraft Electrical System-II (BTAEN-501)

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.

Paper-II

Aircraft Instrument System-II (BTAEN-502)

Autoflight (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)

- a) 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.

Paper-III

Aircraft Radio Communication/Navigation-II (BTAEN-503)

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;

SEMESTER-VI

Paper-I

Principle of Management (BTAEN-601)

- 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

Paper-II
Applied Mathematics (BTAEN-602)

Module 1	Determinants
Module 1.1	Properties of the Determinant
Module 1.2	Determinants of Matrices of Higher Order
Module 1.3	Applications of Determinants and Matrices
Module 2	Differential Equations
Module 2.1	Basic Concepts
Module 2.2	Order of a differential equation
Module 2.3	Degree of a differential equation
Module 2.4	Linear Differential Equations
Module 2.5	Separable Differential Equations
Module 2.6	Linear Second Order Equations
Module 2.7	<i>Real, Distinct Roots</i>
Module 2.8	Complex Roots
Module 2.9	Systems of Differential Equations
Module 3	INTEGRALS
Module 3.1	Basic Integration
Module 3.2	Solving Indefinite Integration
Module 3.3	Integrals are Summations
Module 3.4	Area Under The Curve
Module 3.5	Integration as an Inverse Process of Differentiation
Module 3.6	Definite Integrals
Module 3.7	Properties of Indefinite Integration
Module 3.8	Examples of Indefinite Integration
Module 3.9	The Fundamental Theorem of Calculus
Module 3.10	Table of Indefinite Integrals
Module 3.11	The Total Change Theorem
Module 3.12	The Substitution Rule
Module 3.13	Integrals of Symmetric Functions
Module 3.14	Integration By Parts
Module 3.15	Trigonometric Integrals
Module 3.16	Trigonometric Substitution
Module 3.17	Integration of Rational Functions By Partial Fractions
Module 3.18	Comparison between Differentiation and integration

Module 4	Permutation & Combination
Module 4.1	Permutation
Module 4.2	Circular Permutations
Module 4.3	Permutations when all the objects are distinct
Module 4.4	Circular permutations
Module 4.5	Restricted – Permutations

Module 5	Trigonometry
Module 5.1	Angles
Module 5.2	Radian measure
Module 5.3	Relation between radian and real numbers
Module 5.4	Relation between degree and radian
Module 5.5	Notational Convention
Module 5.6	Trigonometric Functions
Module 5.7	The Six Trigonometric Functions
Module 5.8	Trigonometric equations

Paper-III **Physics (BTAEN-603)**

Module 1 Bonding in solids

Module 1A	Introduction
Module 1B	Cohesive energy
Module 1C	Calculation of cohesive energy of ionic solids
Module 1d	Cohesive energy of Sodium Chloride (NaCl) crystal
	<i>Solved problems</i>
	<i>Information for quiz</i>

Module 2 Principles of Quantum Mechanics

Module 2A	Derivation of de Broglie Equation for matter wave
Module 2C	Davisson and Germer's Experiment
Module 2D	G.P Thomson's Experiment
Module 2E	Schroedinger Wave Equation (Time Independent)
Module 2F	Physical Significance of Wave Function
Module 2G	Particle in a Potential box
	<i>Solved problems</i>
	<i>Information for quiz</i>

Module 3 Magnetic Properties

Module 3A	Introduction
Module 3B	Origin of magnetic moment

Module 3C	Magnetic moment due to electro spin & Bohr magnetron
Module 3D	Classification of magnetic materials
Module 3E	Dia-magnetism
Module 3F	Para-magnetism
Module 3G	Magnetic domains
Module 3H	Ferro-magnetism
Module 3I	Domain theory of Ferro – magnetism
Module 3J	Hysteresis curve
Module 3K	Ferri – magnetism – Ferrites & their applications
Module 3L	Anti ferro – magnetism
Module 3M	Requirement of magnetic materials for different purposes

Solved problems

Information for quiz

Module 4 Semiconductors

Module 4A	Introduction
Module 4B	Intrinsic Semiconductors
Module 4C	Extrinsic Semiconductors
Module 4D	Minority carrier life time
Module 4E	Drift and Diffusion
Module 4F	Einstein relation
Module 4G	Equation of continuity
Module 4H	Hall effect
Module 4I	P-N junction
Module 4J	Width of depletion layer of the P-N junction
Module 4K	Volt-ampere characteristics
Module 4L	Zener diode
Module 4M	Varactor (varicap) diode
Module 4N	Light Emitting Diode (LED)
Module 4O	Solar cells

Solved problems

Information for quiz

Module 5 Lasers

Module 5A	Introduction
Module 5B	Einstein coefficients
Module 5C	Pumping and population inversion
Module 5D	Ruby laser
Module 5E	He-Ne laser
Module 5F	Semiconductor laser
Module 5G	Applications of laser

Solved problems

Information for quiz

Module 6 Fibre optics

- Module 6A Introduction
- Module 6B Principle of optical fibre
- Module 6C Numerical aperture
- Module 6D Step-index fibre-transmission of signal
- Module 6E Graded index fibre – transmission of signal
- Module 6F Optical fibres in communication and sensing application

Solved problems

Information for quiz

Paper-IV
Chemistry (BTAEN-604)

MODULE 1 ATOMIC STRUCTURE

- Module 1A Atomic Structure –Introduction
- Module 1B Sub-Atomic Particles
- Module 1C Discovery of Electron
- Module 1D Discovery of Protons and Neutrons
- Module 1E Atomic Models
- Module 1F Wave Nature of Electromagnetic Radiation
- Module 1G Electronic Energy Levels: Atomic Spectra
- Module 1H Chemical Bonding

MODULE 2 ACIDS AND BASES: FUNDAMENTALS

- Module 2A Arrhenius Theory
- Module 2B Bronstedt-Lowry Theory
- Module 2C Lewis Acids and Bases
- Module 2D Reactions of Acids and Bases with Water
- Module 2E Equilibrium Equations
- Module 2F Strengths of Acids and Bases (The pH and pOH Scales)
- Module 2G pH Concept
- Module 2H Weak acids and Weak Bases

MODULE 3 CHEMICAL KINETICS

- Module 3A Laws of Thermodynamics
- Module 3B Rates of Reaction and the Rate Law for a Reaction
- Module 3C Different Ways of Expressing the Rate of Reaction
- Module 3D Order of Molecularity

Module 3E	Reaction Rates
Module 3F	Rate Laws
Module 3G	Integrated forms of Rate Laws
Module 3H	Simple Second Order Rate Equations
Module 3I	Reaction Mechanisms
Module 3J	Chain Reactions

MODULE 4 FUNDAMENTALS OF ORGANIC CHEMISTRY

Module 4A	Introduction
Module 4B	Empirical and Molecular Formulas
Module 4C	Structural Isomerism
Module 4D	Naming of Alkanes
Module 4E	The Importance of Functional Groups

MODULE 5 ELECTROCHEMISTRY

Module 5A	Faradays Laws
Module 5B	Redox Reactions
Module 5C	Electrochemical Cells
Module 5D	Industrial Electrochemistry:

MODULE 6 GASEOUS STATE

Module 6A	Boyle's Law
Module 6B	Charles' Law
Module 6C	Graham's Law of Gaseous Diffusion

MODULE 7 ENVIRONMENTAL CHEMISTRY

Module 7A	The Atmosphere
Module 7B	The Hydrosphere
Module 7C	The Geosphere
Module 7D	The Biosphere
Module 7E	The Flora and Fauna
Module 7F	Natural Resources Consumption
Module 7G	Atmospheric Chemistry
Module 7H	Air Pollution
Module 7I	Aquatic Chemistry and Water pollution
Module 7J	Soil Chemistry

Paper-V
English (BTAEN-605)

MODULE 1 Communication

- Module 1A Importance of Communication
- Module 1B Communication Basic Forms
- Module 1C The Process of Communication
- Module 1D Barriers to Communication:
- Module 1E Dealing with Communication Barriers

MODULE 2 Nonverbal Communication

- Module 2A Characteristics of Nonverbal Communication
- Module 2B Components of Nonverbal Communication

MODULE 3 Listening

- Module 3A Importance of Listening
- Module 3B Barriers to Effective Listening
- Module 3C Approaches to Listening
- Module 3D Better Listener
- Module 3E What Speakers Can Do to Ensure Better Listening

MODULE 4 Interviewing

- Module 4A Planning the Interview
- Module 4B Conducting the Interview
- Module 4C Ethics of Interviewing

MODULE 5 Letter Writing

- Module 5A Understanding the Audience
- Module 5B Organizing Your Message
- Module 5C Business Letters

MODULE 6 Oral Presentation

- Module 6A Introduction
- Module 6B Preparing to Give an Oral Presentation

Module 6C Making the Presentation
Module 6D Summary

Paper-VI
Social Ethics (BTAEN-606)

UNDER CONSTRUCTION

SEMESTER-VII
Paper-I
Production Planning & Control (BTAEN-701)

Scope of Production Management : Elements of production-the production cycleNecessity 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 PERT. 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 a 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

Paper-II

Management of System (BTAEN-702)

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.

TextBooks:

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

Paper-III
Control Theory & Practice (BTAEN-703)

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 margin on the BODE plot, Time delay effects.

The root locus 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 quantization 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.

TextBooks:

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. Douglas 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

Paper-IV

Strength of Material (BTAEN-704)

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, modules 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.

TextBooks :

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

SEMESTER-VIII
Paper-I
Air Navigation (BTAEN-801)

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.

TextBooksand 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

Paper-II

Aircraft General Systems (BTAEN-802)

General Maintenance Practices : Jacking, levelling, and mooring, refuelling and defuelling of aircraft, safety precautions. Hydraulic and fluid systems, precautions against contamination. Identification colour coding, symbols and other markings to identify the fluid systems.

Hydraulic system : Advantages and disadvantages: types of circuits: flow through pipes: pumps and motors: static performance: actuators: seals and backup rings: reservoirs: accumulators: contamination control filters: tubings and hose pipes: indicating and warning systems: emergency and redundant systems valves: flow dividers and integraters: cooling systems.

Servo-Control System : Stability and response: electro-hydraulic servo systems: position and force feedback: frequency response: principles of automatic control

Pneumatic Systems : Airconditioning and pressurisation systems: deicing systems: heat loads: plumbing: cold air units: compact heat exchangers: valves: filters: air bottles: capsules and bellows: indication and warnings.

Oxygen Systems: Gaseous and liquid oxygen systems: breathing masks: oxygen regulators: oxygen bottles: liquid to gas converters: emergency systems: pressure suits: indication and warnings.

Landing Gear Systems : Types of landing gears and their design principles: shock absorbing devices: retracting mechanisms: wheels and brakes: antiskid system: steering systems: indications and warnings.

Fuel Systems : Types of fuels: their properties and testing: colour codes: fuel requirements: pumps: fuel transfer systems: fuel tanks: plumbing: valves: indications and warnings.

Lubrication Systems : Types of lubrication systems: lubricants: cleaning agents; Auxiliary Power Unit - Construction and operational features.

Fire Protection Systems : Types of systems: Flame proofing: Fire walls: Fire detection systems: Fire extinguishing systems.

Seat Safety Systems : Ejection seats: Survival packs: Parachutes: Pilot's personal equipment: life rafts: Doors, Windows and Emergency exits, Seat belts.

System Testing : Ground handling equipment.

Textbooks

1. J V Casamassa and RD Bent, Jet Aircraft Power Systems, McGraw Hill.
2. E H J Pallet, Automatic Flight Control, BSP Profession Books.1993
3. Civil Aircraft Inspection Procedures (CAP 459), Himalayan Books25

Reference Books

1. W Thomson, Thrust for Flight, Sir Issac Pitman.1992
2. Michael J. Kroes Thomas W.Wild, Aircraft Power Plants, McGraw Hill
3. Michael J. Kroes, William A Watkins and Frank Delp, Aircraft Maintenance and Repair, McGraw Hill 1993
4. Airframe and Power Plant, Mechanics General Hand Book (EA-AC 65-9A), Himalayan Books1994

Paper-III

Engineering Thermodynamics (BTAEN-803)

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 JouleThomson 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.

TextBooks :

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 McGrawHill 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

Paper-IV**Maintenance of Radio & Communication Systems (BTAEN-804)**

Basics of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests. Composition, performance (stability and tolerance) and limitations of the fixed resistors and varistors (carbon composition, carbon film, wire wound and metallic film).

AC and DC measuring instruments.

Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units.

Basics of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.

Construction and Identification of various types of antennas; the voltage and current distribution along antenna of various length; characteristics of ground planes.

Very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate range of communication (line of sight) with given data.

The performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers.

Theory of operation, performance level and specifications of an Audio Integration System.

Working principles and testing of Lead Acid and Nickel Cadmium and Silver Zinc batteries

Principles, Characteristics and operation of the undermentioned systems:

- ‡ Automatic Direction Finder (ADF) Systems,
- ‡ Very High Frequency (VHF) Omnidirectional Range System.
- ‡ Instrument Landing Systems,
- ‡ Weather Radar Systems.
- ‡ Microwave Devices.
- ‡ Air Traffic Control (ATC) Transponder System.
- ‡ Omega Navigation System.
- ‡ Radio Altimeter Systems
- ‡ Cockpit Voice Recorder.
- ‡ Distance Measuring Equipment
- ‡ Doppler Navigation System.
- ‡ Microwave Landing System
- ‡ GPWS
- ‡ Emergency Locator Transmitters.
- ‡ Computers

‡ Simulators.

‡ Flight Control Systems.

Basics of state-of-the-art communication and navigation systems.

Principles of Satellite Communications and its application to aircraft.

TextBooks:

1. RF Hansforde, Heywood and Company London: Radio Aids to Civil Aviation.
2. George Kannedy: Electronic Communication System, McGraw Hill
3. Brian Kendal: Manual of Avionics, Blackwell

Reference Books:

1. Dennis Reddy and John Cooler: Electronic Communication, Prentice Hall of India, New Delhi.
2. J. Powell: Aircraft Radio Systems, Himalayan Books
3. Keith W. Bose: Aviation Electronics, Jeppesen