Department of Technology
Savitribai Phule Pune University
(Formerly University of Pune)
Board of Studies
Aviation
Curriculum Structure for B.Tech Program

Sr. No.	Subject Code	Subject Name	Credits	Teaching Scheme (Theory)	Teaching Scheme (Lab)	Teaching Scheme (Tutorial)
Semester -1						
1.	BAV101	Aerodynamics	4	3		1
2.	BAV102	Mathematics	3	2		1
3.	BAV103	Avionics Technology Fundamentals	4	3	2	
4.	BAV104	Electrical & Instruments Fundamentals	4	3	2	
5.	BAV105	Radio & Radar Fundamentals	4	3	2	
		Total	**19**			
Semester -2						
6.	BAV201	Flight Dynamics	4	3		1
7.	BAV202	Meteorology-1	4	3	2	
8.	BAV203	Navigation	3	3		
9.	BAV204	AC Systems Mechanical	4	3		1
10.	BAV205	Propulsion	4	3		1
		Total	**19**			
Semester -3						
11.	BAV301	AC Systems-Electrical	4	3		1
12.	BAV302	Human Factors & Flight Safety	3	2		1
13.	BAV303	Aircraft Structures	2	2		
14.	BAV304	Meteorology-2	4	3	2	
15.	BAV305	Simulator Flying	6	6		
		Total	**19**			
Semester -4						
16.	BAV401	PPL Flying Training	20			

		Total	**20**			
Semester -5						
17.	BAV501	CPL Flying Training	20			
		Total	**20**			
Semester -6						
18.	BAV601	Instrument Rating	20			
		Total	**20**			
Semester -7						
19.	BAV701	Civil Air Requirements	3	3		
20.	BAV702	Soft Skills	3	3		
21.	BAV703	DGCA Exams Preparation	12	12		
		Total	**18**			
Semester -8						
22.	BAVFinProj	Final Project	20			
		Total	**20**			
Total Number of Credits for the course			**155**			

Aerodynamics [L : 3; T:1; P: 0 [-- (4 credits)]

Detailed contents:

Module 1: (3 lectures)
Heavier than air machine, History of Airplane development , Principle stated by Cayley, Gas Laws, Use of Coefficients in aerodynamics, Systems of units in Aviation, Anatomy of an airplane.

Module 2: (10 lectures)
Atmosphere, composition, International standard atmosphere, Atmospheric layers and their characteristics. Variation of p, T and density with altitude, Pressure altitude, density altitude, Newton's Laws of motion, Application to gas flow, Velocity, Momentum, Energy Eqns, Bernoulli's equation, Compressibility and its effects, Subsonic, trans sonic and supersonic flight regimes.

Module 3: (12 lectures)
Airfoil, its geometry, flow over the airfoil, Pressure distribution, centre of pressure, generation of aerodynamic forces (AD), lift, drag and moment, angle of attack and its effect on AD forces, L vs angle of attack curve, movement of CP, aerodynamic centre, stall, wind and smoke tunnels.

Module 4: (10 lectures)
D'Alembert's paradox, Drag, components of drag, Boundary layer theory (BL), Laminar and turbulent flows, BL profile in laminar and turbulent flow, creation of drag due to skin friction, transition of BL, flow separation, Streamlined and bluff bodies.

Module 5: (7 lectures)
Two dimensional wings, three dimensional wings, Aspect ratio and its effects, Induced drag and its dependence on CL, Winglets, Qualitative study of Flow on 3D wings, Sweep back, Taper and twist to wing and wing setting angle, Wing body blending and interference.

Module 6: (3lectures)
Measurement of airspeed, Pitot tube, its functioning, TAS, EAS, Ground speed, Knots and KMPH, Effects of compressibility on Lift and drag, Introduction to Euler's eqn, Aerodynamics of cricket and golf ball, automobiles, drag reduction techniques, High lift devices. High speed aerodynamics, trans-sonic and supersonic airflows and their characteristics.

Suggested Reference Books
(i) Introduction to Flight, 6th edition. By John D Anderson
(ii) Aerodynamics for Engineering Students. By Houghton and brock
(iii) Flight without Formulae, 5th edition. By AC Kermode
(iv) Introduction to Aircraft Aerodynamics, By Cranfield College of Aeronautics
(v) Handbook of Aeronautics. By Royal Aeronautical Society
(vi) Principles of Flight. By Bert A Shield
(vii) Manual of Flying (AP 129). By Air Ministry UK
(viii) Aerodynamics for Naval Aviators. By H H Hurt, Jr. University of Southern California
(iX) Principle of Flight. By Nordian, DGCA Recommended

Course Outcomes: at the end of this course student will be able to know:

- atmospheric variations in which aeroplane flies
- generation of forces on airplane and how angle of attack contributes significantly

- Important role of friction and compressibility which affects AD forces
- Airfoils, wings, wing shapes and how they contribute to lift and drag
- How airplane speeds are measured

Mathematics [L : 2; T:1; P : -- (3 credits)]

Detailed contents:

Module 1: (10 lectures)
Multivariable Calculus: Differentiation
Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points.

Module 2: (10 lectures)
Sequences and Series
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.

Module 3: (10 lectures)
Multivariable Calculus: Integration (7 hours)
Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

***Module 4: (8 hours*)**
First Order Ordinary Differential Equations (3 hours)
Exact, linear and Bernoulli's equations, Euler's equations.

Module 5: (7 lectures)
Ordinary Differential Equations of Higher Order (6 hours)
Second order linear differential equations with variable coefficients, method of variation of Parameters.

Suggested Reference Books
Text / References:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", Pearson, 2002.
2. T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill, New Delhi, 2010.
4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
5. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
6. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
7. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
8. S. L. Ross, "Differential Equations", Wiley India, 1984.
10. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

Course Outcomes At the end of the course students will be able to
. Understand importance of calculus as language of Engineering
. Understand the fundamental concepts of calculus
. Able to apply calculus to solve engineering problems

Avionics Technology Fundamentals **[L : 3; T:--; P 0: 2 (4 credits)]**

Detailed contents:

Module 1: (12 lectures)
Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number, Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, Basics of Flip flops, Shift Resistors, Counters.

Module 2: (12 lectures)
Semiconductor theory, Diodes, Transistors, Integrated Circuits, Bipolar Junction Transistors, Transistors Bios Circuits, Field Effect Transistors, Metal Oxide Semiconductor FETs.
combinational logic systems, mono-stable devices, bi-stable devices, decoders, encoders, multiplexes, bus systems, computers.

Module 3: (12- lectures)
TTL logic circuits, CMOS logic circuits, Registers, Counters, Data Conversion., LED, photo diodes, photo-resistors, photo transmitters, Optoelectronics , Thyristor.

Module 4: (10 – Lectures)
Introduction to Amplifiers, Single and Multistage Amplifiers, Amplifier Characteristics Feedbacks in Amplifiers, Introduction to Oscillators, Multivibrators (MVS)
Signal Generator, Thyristors, Light Activated SCR (LASCR)

Suggested Reference Books
(i) Electronic Principles. By Paul Malvino
(ii) Applied Electronics. By RS Sedha, S Chand Publications
(iii) Modern Digital Electronics. By Tata McGraw Publications
(iv) Digital Principles. By Paul Malvino
(v) Digital Fundamentals. By Floyd, Universal Book Stall New Delhi
(vi) Grob's Basic Electronics, 11th edition. By Mitchel E Schultz
(Vii) Basic Electronics, Student Handbook

Laboratory -[L : 0; T:0 ; P: 2: -- (-- credits)]
Suggested list of experiments from the following:
1. PN Junction diode characteristics. Forward bias, Reverse bias.
2. Zener diode characteristics and voltage regulator
3. Halfwave Rectifier with and without filter.
4. Fullwave Rectifier with and without filter.
5. Transistor CB characteristics (Input and Output)
6. Transistor CE characteristics (Input and Output)
7. Frequency response of CE Amplifier
8. Frequency response of CC Amplifier (Emitter Follower).
9. UJT characteristics.
10. SCR characteristics
11 FET Characteristics
12 Frequency Response Of CS Amplifier
13 Frequency Response Of CD Amplifier

Introduction to Electrical and Instruments Engineering Fundamentals

[L : 3; T:-0; P : 2 (4 credits)]

Detailed contents:

Module 1: (-- lectures)
Electrical fundamentals: Electron theory, electrostatics, capacitors, current, voltage and resistance, Power and energy, Direct current, Electromagnetism, inductors. Alternating current, transformers and safety.

Module 2: (-- lectures)
Generators and motor principles, AC generators, three phase generation and distribution, AC motors, practical AC generators systems, Batteries, overview, storage cells, Lead acid batteries, Nickel Cadmium batteries, Battery locations.

Module 3: (-- lectures)
Power supplies, Regulator, External power, Inverters, Transformers, Auxillary power units, Emergency power, Wiring and critical protection, Shielding, screening, circuit protection. Various types of displays, Clustering of instruments for logical reading.

Module 4: (-- lectures)
Instruments, transducers: resistive, capacitive, inductive, optical, active, Electric instruments: Flight instruments, Artificial Horizon, Turn and Slip Indicator, Rate of climb/ descent indicator, altimeter, air speed indicator, Engine instruments: Engine rpm, Fuel flow meter, fuel pressure indicator, Turbine exit temperature, Oil pressure gauge, Cylinder head temperature, manifold pressure gauge.

Module 5: (-- lectures)
Navigation Instruments: Gyro Compass and Heading Indicator gauge, VOR Course Deviation Indicator(CDI) Radio direction finder(RDF) and Automatic Direction Finder (ADF) indicator combined with NAV/COM radios set to the frequencies of VOR and ADF stations.[2], w:Horizontal Situation Indicator(HSI) up to Electronic Attitude Director Indicator (EADI), Electronic Flight Instrument System (EFIS), Dual VOR/ADF Course Deviation Indicator(CDI) (Nav1), (ILS) Localizer and Glidescope indicator.

Suggested Reference Books

(i) Grob's Basic Electronics. 11th edition. By Mitchel E Schultz
(ii) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(iii) Instrumentation Aircraft General Knowledge. By Nordian
(iv) JAR ATPL(A) and CPL(A) Instruments. By Keith Williams
(v) Electron Flow Version. 9th edition. By Thomas L Floyd

Course Outcomes: At the end of this course students will be able to understand:

. Fundamentals of instrumentation, need for instruments, various types of working of instruments.
. Grouping of instrument in clusters, Arrangement of instruments for pilot to read them easily. Display type for quick understanding.
. Instrument commonly used in the cockpit: airplane instruments, navigation instruments and engine instruments.
. Basic electricity fundamentals, circuits, system components, motors, generators, protections of circuit.

Laboratory -

Suggested list of experiments from the following:

1. To verify KCL and KVL
2. To study the V-I characteristics of an incandescent lamp.
3. To measure single phase power by using three ammeter method.
4. To measure the single phase power by using three voltmeter method.
5. To perform short circuit test on a single phase transformer.
6. To perform open circuit test on a single phase transformer.
7. To measure three phase power by using two wattmeter method.
8. To verify Superposition theorem.

Radio and Radar Fundamentals [L : 3; T:1; P 0: -- (4 credits)]

Detailed contents:

Module 1: (6 lectures)
To present the basics concepts of telecommunication systems with focus on digital and wireless 3 Basic Concepts: Signal Analog, Digital, Random, Sampling, Bandwidth, Spectrum, Noise, Interference, Channel Capacity, BER, Modulation, Multiplexing, Duplexing. Telecommunication Sign,

Module: 2 (6 Lectures)

What is Telecommunication, Transmission Medium, Data Communication, IP Telephony, Cellular Network, GSM, GPRS / EDGE, 3G Network – UMTS/WCDMA and HSPA, 5G, M2M – Machine to Machine (M2M), Internet of Things (IoT), The Internet and Internet Protocol, Cloud Computing and Data Cente, Wireless Radio System Applications.

Module 3: (7 lectures)
Basic Principle of operation, Signal Routing, Signal Timing, Ranging, Maximum Unambiguous Range, Radar Waveforms Minimum Slant Range,
Direction determination, Bearing, Elevation Height Accuracy, Radar Resolution, Angular Resolution , Range Resolution, Theoretical Maximum Range. Rangeion.
Antenna Gain, Antenna Aperture, Radar Cross Section. Transmitters, Power, MDS-Echo, Noise.

Module 4: (8lectures)
Radar Range Equation, Probability of Detection, Frequency-diversity

Classification of Radar Systems, Imaging Radar / Non-Imaging Radar, Primary Radar, Pulse Radar, Monostatic / Bistatic Radars, Secondary Radar, Principle of operation, Comparison Primary Radar vs. Secondary Radar, Continuous Wave Radar, Block Diagram of an CW-Radar, Multi Function Radars, Multi-Target Tracking Radar, Air Traffic Control (ATC) Radars .En Route Radars, Air Surveillance Radar, Precision Approach Radar, Surface Movement Radar (SMR), Special Weather Radar Applications, Radar Frequency Bands.

Module 5: (8 lectures)
Functions of an Antenna, Antenna Characteristics, Antenna Gain, Antenna Pattern, Polarization, Half-wave Antenna, Parabolic Antennae, Antennae with Cosecant Squared Pattern, Phased Array Antenna, Principle of Operation, Linear Array , Planar Array, Frequency Scanning Array, Phase Shifter, Monopulse Antennae, Monopulse Concept, Conical Scan.

Module 6: (8 lectures)
Radar Transmitter, Tasks of a radar transmitter, Division of radar transmitters, High-Power Oscillator as Transmitter, High-Power Amplifier as Transmitter, The Concept of “Coherence”, Non-coherent Radar Processing, Coherent Radar Processing , Pseudo-coherent Radar, Disadvantages of the pseudo-coherent radar, Modulator, Thyratron, Power modules,
Waveform-Generator, Pulse Compression, SAW- Devices, Time-Side-Lobes, Pulse compression with non-linear FM waveform. Velocity-modulated Tubes.
Klystron Amplifier, Carcinotron, Reflex Klystron or Repeller Klystron, Traveling Wave Tube, Magnetron, Crossed-Field Amplifier, Extended Interaction Klystron (EIK), Extended Interaction Oscillator (EIO),

Suggested Reference Books

(i) Basic Radar Analysis. By Mervin C Budge, Shawn R German
(ii) Fundamentals of Telecommunications. By International Centre for Theoretical Physics-
(iii) ebookpdf.com/basic-radar-books
(iv) Radar Fundamentals. By Gershon J Wheeler

Introduction to Flight Dynamics [L : 3; T:1; P 0: -- (4 credits)]

Detailed contents:

Module 1: (8 lectures)
Introduction, Airplane performance, Stability and Control, Meaning and need to study, Airplane parts, their function, Co-ordinate axis used, Possible motions, translational and rotational. Control surfaces responsible for each motion, pitch, roll and yaw. Pure and coupled motions. Drag, drag polar, components of drag. Lift dependent drag and other components, source of various components of drag, Factors affecting drag, Minimum drag condition. L by D ratio, Lift versus drag ratio.

Module 2: (8 lectures)
Performance of a airplane, St and level flight, Thrust versus altitude, thrust versus forward speed, Thrust required and thrust available for piston engines. Thrust required and available for Jet engine airplane. Max velocity attainable for piston engine and jet engine. Effects of power required and available on piston engine airplane with altitude. Effects of thrust required and available with altitude. Rate of climb, max rate of climb. Gliding flight, range of gliding flight, max gliding distance. Service ceiling and absolute ceiling, time to climb, Range and endurance. Maximum range and max endurance.

Module 3: (8 lectures)
Accelerated Flight, take-off and landing performance, both by graphical method. Turning flight, forces in turning flight, Load factor in turn, radius of turn, time to turn, Velocity versus load factor

Module 4: (8 lectures)
Stability of an airplane, concept, stable and unstable airplanes, neutral stability, static and dynamic stability, Moments on the airplane, absolute angle of attack, moment balance, longitudinal static stability, criterion, qualitative discussion on longitudinal stability, contribution by main wing, fuselage and tail, Neutral point, static margin. CG calculation.

Module 5: (8 lectures)
Control, concept of control, forces and moments, longitudinal control, control surfaces, control tabs. Trimming of airplane in longitudinal direction. Stability versus control dilemma. Directional and lateral stability, Directional and lateral control. Stick Force , Powered controls.

Module 6: (5 lectures)
High lift devices,plane flaps, slots, multi slotted f flaps, fowler flaps, leading edge devices, their location and operation, stall warning, low drag airfoils, wing sweep and dihedral. BL control on wings of various shapes, vortex generators, BL trippers, their location.

Suggested Reference Books
(i) Introduction to Flight, 6th edition. By John D Anderson
(ii) Flight without Formulae,5 th edition. By A C Kermode
(iii) Fundamental of Flight ,2nd edition. By Richard S Shevell
(iv) Flight Planning Flight Performance & Planning. By Nordian

Course Outcomes

. Understand what is performance of an airplane and understand straight and level flight, climb, glide, TO, Landing phases of flights
. Max speed, max endurance and max range criteron

- Familiar with stability and control aspects of an airplane
- Understand generation of moment on airplane and how it affects stability
- Important role of position of CG and tail in stability
- How an airplane is controlled and what are pilot interventions.

Meteorology -1 **[L : 3; T:0; P :2 -- (4credits)]**

Module1: (4 lectures)

An over view of aviation organisation and objective, structure and working of WMO, ICAO, CAeM, DGCA, IMD and AAI.

Measurement of Time - LMT, Universal time, Differences in LMT, Time zones, International Date Line.

Elementary concepts of atmospheric sciences: Our atmosphere and its composition, extent and vertical division. ICAO ISA and ISA deviation, JSA atmosphere, High Altitude and hypoxia.

Module 2: (8 lectures)

Atmospheric pressure- Definition, basic principle of Pressure measurement, Unit, kind of barometer, aneroid and mercury barometers, barograph measurement, Geo-potential meter. Atmospheric Pressure and its variation, reduction of pressure to mean sea level, QFF, QNH, QNE, QFE. Static pressure, dynamic pressure, pitot pressure.

Altimetry - Definitions. Principle of Altimeter. ICAN Altimeter and Radio Altimeter. Errors of Altimeter. Altimeter Setting Procedures. Correction to altimeter and D-Value. Pressure altitude, true altitude, height, altitude, flight level, Altimeter settings: QNH, QFE, 1013.25 hPa, effect of accelerated airflow due to topography. Terrain clearance, Minimum flight level.

Air Density and density altitude, effect of changes in pressure and temperature on air density, density variation with altitude and latitude, High density altitude, Low density altitude and aircraft operations.

***Module 3*: (10 lectures)**

Temperature- Insolation, Unequal distribution of solar energy over the surface of the globe, Depletion of solar radiation, Variation of temperature with Altitude, Latitude, topography and seasonal. Effect of temperature on land and sea. Diurnal variation, Temperature scales. Dry bulb, wet bulb, maximum and minimum thermometer, Stevenson screen, Radiation balance, transfer of heat- solar and terrestrial radiation, conduction, convection, condensation, advection. Lapse rate, stability and instability, development of inversions, types of inversions.

Humidity - Moisture in atmosphere and basic principle of measurement of humidity, relative humidity, humidity mixing ratio, variation of humidity- diurnal, latitudinal, seasonal. Instruments including Psychrometric measurements, Psychrometric tables, Errors, saturation of atmosphere, dew point temperature, wet-bulb temperature, dews and frost, effect of cooling in the atmosphere, formation of clouds, fog and precipitation, many phases of water, condensation nuclei, super cooled water.

Wind – Concept of wind circulation, Effective Forces and wind, PGF, Coriolis force, Frictional force, Geostrophic and gradient winds, cyclostrophic wind, cross-isobar wind flow, cyclonic and anticyclonic wind, Measurement of surface wind speed and direction. Local winds: land-sea breezes, mountain-valley breezes, katabatic-anabatic winds, jet-stream, thermal wind, veering and backing of winds, convergence and divergence of winds. Reporting procedure of wind direction and speed. Reporting procedure of variation of wind direction and speed.

Precipitation – kind of precipitations, rain and snow measurement, Rain guages, Rain recorder – Self Recording (float type), Intensity of precipitation.

***Module 4*: (10 lectures)**

Cloud- types of cloud, features and identification. Cloud Observation and Measurements - Estimation of amount, Height of the base, its measurements, Ceiling balloon, and Aircraft observations. Ceilometer & Ceilograph; principle and use.

Atmospheric Stability – Concept of air parcel, ELR, DALR, SALR, Equilibrium States, Parcel Method, Vertical Acceleration of the parcel and its application. Stability Analysis.

Visibility Measurement for Aviation – Definition of visibility, Prevailing visibility, Reporting Procedure of visibility, Directional variation in visibility,
Landmarks. Runway Visual Range: Definition, landmarks. Transmissometer (Single base and Dual base), their installation, Reporting RVR practical aspects.

IFR producers- Common visibility reducers**,** Hydro, Litho, Electro and Photo meteors, Definition and description of smoke, dust, smoke, sand, volcanic ash. Radiation fog, advection fog, sea fog, steam fog, upslope fog, frontal fog, evaporation fog, ice fog, mist, shallow fog, dew, frost,

Pressure systems- Location of principle areas pressure, High and Low pressure, Anticyclones, type, general properties of cold and warm anticyclones, ridges and wedges, subsidence, Non-frontal low, depression, cold air pools, trough. Weather associated with pressure systems. Tropical revolving storms.

***Module 5*: (6 lectures)**

Indian Climatology - Different seasons. Distribution of Means Sea level pressure/wind/temperature in different seasons. Wind circulation and temperature distribution over India in lower, middle and upper troposphere in different seasons. Indian rainfall in different seasons. Indian summer monsoon, onset, withdrawal, rainfall distribution, inter annual variability of monsoon. Main synoptic pressure systems causing weather over India in different seasons.

Synoptic systems in different seasons. Winter - Western disturbance, Rossby Waves, Westerly Jet Stream, Fog, Cold Wave etc.

Summer - Thunderstorms, Dust storms, Heat wave, Nor'westers, Andhi, Loo, Cyclonic disturbances in Indian region.

Monsoon - Onset, rainfall activity, Withdrawal, Breaks, Depressions, Easterly Jet Stream. Mid-tropospheric Cyclones, Component of monsoon season- heat low, TEJ, Mascerene high, Tibetan high, LLJ, monsoon trough.

Post Monsoon - Cyclones in the Indian Seas, N.E. Monsoon.

***Module 6*: (6 lectures + Practicles)**

Station plot- coding and decoding of weather elements on surface chart, TEMP message from RSRW, plotting of weather elements on surface level and upper level constant pressure charts and decode them.

Aviation Weather Codes – Metar/Speci, Meteorological Routine Report, Weather Symbols and RAREP, Conditions for issuing SPECI, Accuracy requirement for observation of weather elements in aviation.

List of Practicals :

- **TYPE I :** Aviation Weather Codes Coding and De-Coding: Metar/Speci ;
  - Trend type Landing Forecast : Terminal Aerodrome Forecast.
- **TYPE II :** Exercises in issue of Local forecast, Terminal Aerodrome forecast
  - and Trend type landing forecast.
- **TYPE III :** Exercise in issue of Route forecast within the country / Ex – India.

Reference Books:

1. Annex 3 - Meteorological Service for International Air Navigation- ICAO publication
2. Essential of Meteorology: An invitation to the atmosphere by C. Donald Ahrens
3. Aviation weather by Peter Lester
4. Meteorology and Flight : A pilot's guide to weather by Tom A. M. Bradbury
5. Weather analysis and forecasting Vol. 1 and 2 by Sverre Pettersson, MG Hills

6. An Introduction to Meteorology by S. Pettersen
7. The Monsoons by P.K. Das (National Book Trust, India)
8. WMO Training Manuals for class I & II, WMO (Publications)
9. Aviation Weather: FAA AC 00-6A (FAA Handbooks)

Navigation [L : 3; T:0; P 0: -- (3credits)]

Detailed contents:

Module 1: (5 lectures)
Maps and Charts, Great Circle, small circle, Earth shape & size, Long and Lat, Direction, course, Bearing, Solar time, GMT, local mean time, time and latitude relation, speed measurement units miles. Kms, statute mile, nautical miles, and conversion.

Module 2: (7 lectures)
Charts and projections, Co-ordinates, Mercator projection, Gnomonic projection, Conical Orthomorphic projection, Aeronautical charts, scale, standard chart symbols, Hydrography, Vegetation, Aeronautical information.

Module 3: (8 lectures)
Flight planning, ATC, Flight Information Publications (FLIP), Area planning, Flight Information Hand Book (FIH), FLIP en-route charts, Terminal Area Charts, NOTAM, Airways, Special use air space, IFR, VFR Flight Plans.

Module 4: (8 lectures)
Earth's magnetic field, Compasses, magnetic and direct indicating magnetic compass, Gyroscope, its properties, errors, caging, gyro magnetic compass, Directional Gyro, Gyro magnetic compass indicator.

Module 5: (8 lectures)
Indicated Air Speed (IAS), Calibrated Air Speed (CAS), Basic Air Speed (BAS), Equivalent Air Speed (EAS), True Air Speed (TAS), Computing CAS, Mach number, Mach Meter, Air speed Indicator (ASI), Air Data Computer (ADC), Effect of wind, wind triangle solution, Plotting procedure, Dead reconing, Basic Navigation, Plotting, Plotting procedure, Measuring course and distance.

Module 6: (9 lectures)
Navigation Systems, GPS, Types of systems, Components, Sensors, computer, astro tracker, Doppler, Heading system, Nav Aids, pressure altimeter, Temp sensor, Radar, Inertial Nav System (INS), Types of INS systems, Components, stable platform, Gyros, accelerometers, Integrators, Clock errors, Celestial Technique.

Suggested Reference Books
(i) FAA-H-8083-18 Handbook of Navigation, 2011 edition. By Federal Aviation Administration.
(ii) Air Pilot's Manual Vol 3 & 5. By Peter D Godwin
(iii) Flight Performance & Planning. By AS Nordian
(iv) General Navigation: ATPL JAR. By AS Nordian
(v) GPS : Navigation. By Underdown
(vi) GPP : Plotting & Flight Planning. By Underdown
(vii) Radio Navigation ATPL JAR. By AS Nordian

Course Outcomes: At the end of the course the student will be able to know:
. How to read and understand maps, earth's shape and size, co-ordinate system used
. Relation between time, latitude, standard time. Units of measurement of distance.
. Aeronautical charts and how to use them. How to use Aeronautical maps for planning flight near the airport and on way to destination.
. Gyroscope and instruments based on Gyroscope. Different speeds and conversion to TAS.
. Inertial Navigation, GPS and modern auto navigation systems.

Aircraft Systems - Mechanical [L : 3; T:1; P :0 -- (4 credits)]

Detailed contents:

Module 1: (8 lectures)
Hydraulic Systems (Hyd). Need for the system, requirements of Hyd system, Characteristics of Hyd System, Services provided by Hyd system in small and large airplanes. Typical layout of the Hyd systems for large and small airplanes. Important components, their function. Operating features of the system.

Module 2: (8 lectures)
Pneumatic and De-icing Systems (Pnu) . Need for the system, requirements of the system, Characteristics of the System, Services provided by Pnu system in small and large airplanes. Typical layout of the Pnu systems for large and small airplanes. Important components, their function. Operating features of the system.

Module 3: (7 lectures)
Air conditioning and Pressurisation Systems (P&AC). Need for the system, requirements of the system, Characteristics of the System, Services provided by P&AC system in small and large airplanes. Typical layout of the P&AC systems for large and small airplanes. Important components, their function. Operating features of the system.

Module 4: (8 lectures)
Flight Control Syatems (FCS). Need for the system, requirements of the system, Characteristics of the System, Services provided by FCS system in small and large airplanes. Typical layout of the FCS systems for large and small airplanes. Important components, their function. Operating features of the system. Powered, Power assisted and manually operated sys, Artificial feel unit, Changes of control input with speed and altitude.

Module 5: (6 lectures)
Landing Gear Systems (UC). Need for the system, requirements of the system, Characteristics of the System, Services provided by UC system in small and large airplanes. Typical layout of the UC systems for large and small airplanes. Important components, their function. Operating features of the system.

Module 6: (8 lectures)
Airplane Fuel Systems (Fuel). Need for the systems, requirements of the system, Characteristics of the System, Services provided by Fuel system in small and large airplanes. Typical layout of the Fuel systems for large and small airplanes. Important components, their function. Operating features of the system. Refuelling and defueling, precautions, water content check.

Suggested Reference Books
(i) FAA Handbook of Hydraulic Systems. By Federal Aviation Administration
(ii) Aicraft Hydraulic System. By William A Leese
(iii) Handbook of Aeronautics. By Royal Aeronautical Society
(iv) Aircraft Hydraulic System. By William L Green
(V) The Air Pilot's Manual 4-The Aeroplane-Technical. By Airlife Publishing Company

Course Outcomes: At the end of the course the student will be able to know;

. Need for different airplane operating systems
. Characteristics of different systems
. Services provided by the different systems
. Typical layouts of different systems for big and small airplanes
. Peculiarities of some of the systems

Propulsion [L : 3; T:1; P : 0 (4 credits)]

Pre-requisites:
High-school education with 10+2 with Science and Mathematics or diploma in relevant engineering branch

Detailed contents:

***Module 1:** (7 **lectures**)*
Introduction, thermodynamic system, properties and state of a system, point and path functions, Thermodynamic processes – reversible and irreversible, Thermodynamic processes – isothermal, adiabatic, isobaric, isochoric, etc., First law of thermodynamics, perpetual motion machine, high grade and low grade energies, Work and Energy, Second law of thermodynamics, Enthalpy and Entropy, Efficiency, Ideal Gas Laws – Boyle's law, Charles's law, Combined gas laws, thermodynamic cycles.

Module 2: (7 lectures)
Carnot cycle – work, energy and efficiency, Otto cycle - work, energy and efficiency, Brayton cycle - work, energy and efficiency

Basics of Heat Transfer: Conduction – mechanism of heat transfer, Law of conduction, Conductors and insulators, Convection – mechanism of heat transfer , Natural and Forced convection, rate of heat transfer, Radiation – mechanism of heat transfer, black body, relation with temperature, Stephan Boltzmann constant

Module 3: (8 lectures)
The spark ignition engine, Engine construction and main components, Multi cylinder engine and Engine classification, Theoretical 4 – strokes: suction/induction, compression, power, exhaust, Practical cycle – valve timing and ignition timing, Engine power – Indicated power, Brake Power, Engine Efficiency – thermal, mechanical, volumetric, Specific Fuel Consumption, Effect of change in ambient conditions on the engine performance,

Power Augmentation – supercharger and turbocharger

***Module 4:** (7 **lectures**)*
Auxiliary systems:

Lubrication system – construction and working, types - dry sump and wet sump

Engine cooling system – working and control

Starting and Ignition system – components and working

Fuel system – carburettor and direct injection

Fuel – mixture, detonation, pre-ignition, octane rating, fuel additives

Fuel quality, fuel quality control

Module 5: (6 lectures)
Propellers: Fixed pitch and variable pitch, alpha and beta range, single acting propeller, constant speed propeller, constant speed unit, propeller control unit, feathering and unfeathering, beta range operations, reduction gearing, torque meter, checks

Module 6: (10 lectures)
Jet Engine introduction, principle of working and working cycle, equation of thrust, propulsive efficiency, bypass ratio, types of jet engines – turbojet, turbofan, turboprop, turboshaft, spools, limiting temperature, afterburner, study of construction and working of main components – air intake, compressor, combustion chamber, turbine, nozzle/exhaust system, thrust, TSFC & BSFC, change of thrust with change in ambient conditions, thrust augmentation, bleed air, gear boxes, Ignition system, APU, Engine starting, Gast Turbine Fuel and Fuel system.

Suggested Reference Books
(i) JAA Powerplant Manual – Oxford Aviation Services
(ii) The Jet Engine – Rolls Royce
(iii) Engineering Thermodynamics – P K Nag, McGraw Hill
(iv) Aircraft General Knowledge: Powerplant – Nordian (DGCA recommended for CPL/ATPL exam)

Course Outcomes
On successful completion of the course, the student will be able to –
1. Understand and apply the principles of thermodynamics and heat transfer to analyse simple thermal systems
2. Understand the construction and working of piston engines
3. Understand the working and control of the propeller used on aircrafts
4. Understand the construction and working of piston engines

Aircraft Systems- Electrical- [L : 3; T 1; P : 0 (4 credits)]

Detailed contents:

Module 1: (10 lectures)
Elect System: System requirements, services operated, Components, Electrical Power Source: Alternator , Battery, Inverter, Rectifier, TR unit, CSD, Voltage regulator, Volt, Ampere, Ohm, Watts, Power factor, AC & DC current, Poly phase system, Paralleling of alternators & batteries, concept, Infinite Bus Bar, Electrical system protection , fuse, CB, Characteristics of system, Layout Electrical power distribution in small light aircraft and heavy jet aircraft

Module 2: (10 lectures)
Instruments: Gyroscope: - Gyro Fundamentals, Rigidity, Precession Free Gyro, Tied Gyro, Gyroscopic Drift and Topple, Real Drift, Apparent Drift, Transport Drift, Ring Laser Gyro. Direction Gyro Indicator: Construction and Principle of Operation, Erection System, Gimbal error, Drift calculations, Drift compensation. Artificial Horizon, Construction and Principle of Operation, Erection, Mechanism, Acceleration Errors.
Turn and bank Indicator: - Construction and Principle of Operation, Turn Coordinator. Altimeter, Airspeed Indicator, Vertical Speed Indicator.

Module 3: (10 lectures)
Avionics System: Electronic Flight Instruments, Introduction, Primary Flight Display (PFD), Primary Flight instruments, Navigation Instruments,Flight Status Information, Awareness: Using Standby Instruments. Navigation: Area Navigation (RNAV) Basics, RNAV Concept, FMS/RNAV computer, FMS/RNAV/Autopilot Interface: Display and Controls, Accessing Information in the FMS.

Module 4: (10 lectures)
Automated Flight Control, Introduction, Autopilot Concepts, Specification of Track and Altitude, Engagement of Autopilot Function, How Autopilot Functions Work, Pre-flight Preparation, Function To Cross-Check Calculations, Check the Waypoints, Check the Distances, Check the Desired Tracks, Check for Route Discontinuities, Flight Director, Flight Director Functions, Using the Flight Director (FD), Flight Director Without Autopilot, Flight Director With Autopilot.

Module 5: (5 lectures)
Information Systems, Introduction, Multi-Function Display, Moving Maps, Using the Moving Map, Maintaining the "Big Picture".
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Suggested Reference Books
(i) Aircraft Electrical Systems,3rd edition. By EHJ Pallett
(ii) Aircraft Instruments, 2 nd edition. By EHJ Pallett
(iii) Aircraft Electricity and Electronics. 6th edition. By Thomas K Eismin
(iv) Aircraft Electrical and Electronics Systems. 1st edition. By Mike Tooley and David Waytt

Human Factors and Flight Safety [L : 2; T:1; P 0: -- (3 credits)]

Detailed contents:

Module 1: (8 lectures)
Human Behaviour**:** Definitions of Human Behavior, Personality Types, Instructor and Student Relationship , Human Needs and Motivation, Human Needs That Must Be Met To Encourage Learning, Physiological, Security, Belonging, Esteem, Cognitive and Aesthetic, Self-Actualization.

Module 2: (8 lectures)
Human Nature and Motivation, Human Factors That Inhibit Learning, Defense Mechanisms, Repression, Denial, compensation, Projection, Rationalization, Reaction Formation, Fantasy, Displacement, Student Emotional Reactions, Anxiety, Normal Reactions to Stress, Abnormal Reactions to Stress.

Module 3: (10 lectures)
The Learning Process: The First Flight, The Check Ride, Discussion of First Flight and Check Ride,What Is Learning? The Framework for Learning, Learning Theory, Behaviorism, Cognitive Theory , Information Processing Theory, Constructivism, Perceptions, Factors That Affect Perception, Physical Organism, Goals and Values, Self-Concept , Time and Opportunity, Element of Threat, Insight, Acquiring Knowledge, Memorization, Understanding, Concept Learning, exercise, Primacy, Intensity, Recency.

Module 4: (12 lectures)
Domains of Learning, cognitive, Affective, Psychomotor. Characteristics of Learning, Learning Styles, Right Brain/Left Brain, Holistic/Serialist, Visual, Auditory, Kinesthetic Learners (VAK), Skill Knowledge, Skill Acquisition, Cognitive and Associative Stage, How To Develop Skills, Types of Practice, Deliberate Practice, Blocked Practice, Random Practice, , Learning To Multitask, Distractions and Interruptions, Fixation and Inattention, How To Identify Fixation or Inattention
The Learning Route to Problem-Solving Tactics, Awareness of Existence of Unknowns,
Errors : Kinds of Error, Slip, Mistake, Reducing Error, Learning and Practicing, Taking Time, Checking for Errors, Using Reminders, Developing Routines, Raising Awareness, Error Recovery, Learning From Error, Motivation, Where Does the Motivation To Learn Come From, Maintaining Motivation, Rewarding Success, Presenting New Challenges, Drops in Motivation, Short-Term Memory (STM), Long-Term Memory (LTM), Remembering What Has Been Learned, How Usage Affects Memory, Forgetting, Retrieval Failure, Fading , Interference, Retention of Learning, Transfer of Learning, Habit Formation,

Module 5: (4 lectures)
Effective Communication **:**Basic Elements of Communication, Source, Symbols, Receiver, Barriers to Effective Communication, Lack of Common Experience, Confusion Between the Symbol and the Symbolized Object. Developing Communication Skills, Role Playing, Instructional Communication, Listening, Questioning, Instructional Enhancement.

Module 6: (3 lectures)
Risk Management **,** Defining Risk Management, Principles of Risk Management, Accept No Unnecessary Risk, Make Risk Decisions at the Appropriate Leve, Accept Risk When Benefits Outweigh the Costs Integrate Risk Management Into Planning at All Level, Risk Management Process, Implementing the Risk Management Process, Level of Risk, Assessing Risk, Likelihood of an Event, Severity of an Event, Mitigating Risk.

Suggested Reference Books

(i) FAA-h_8083-9A Aviation Instructor's Handbook. By Federal Aviation Administration

(ii) Aviation Psychology and Human Factors. By Monica Martinussen and David R. Hunter

(iii) Principles and Practice of Aviation Psychology by Pamela S. Tsang and Michael A. Vidulich

(iv) Aircraft Safety Accident investigations, Analyses and Applications. By Shari Stamford Krause.

Course Outcomes: At the end of the course students will be able to know:

. Basics of human personality, needs, motivation, esteem. Basic human traits.

. Human ability and method of learning. Factors which inhibit learning.

. Ways of learning, different styles of learning, errors and how they occur, Multi-tasking.

. communication skills and risk assessment and risk mitigation.

Aircraft Structures **L : 2; T:0; P 0: -- (2 credits)]**

Students are made aware of construction of aircraft and structural limitations on flying and manoeuvring. Basics of strength of materials are covered. Aircraft construction of various components and loads experienced are covered. Common failures are explained.

Topics covered are:

Introduction to loads, free body diagram, stress and strain, Hooke's law.
Material properties and relation between stress and strain.
Tension, compression and shear. Axial loads and stresses in differently oriented planes.
Torsion.
Beams.
V-n Diagram
Fatigue and creep, Fatigue testing, Case study of Comet airplane.

Reference Books:

Elements of Strength of Material by Timoshenko and Young
Stability and Control by Perkins and Hage

Meteorology -2 **[L : 3; T:0; P :2 -- (4credits)]**

***Module 1*: (6 lectures)**

Atmospheric thermodynamics: Equation of state for dry and moist air, Adiabatic and Isothermal Processes, Humidity Parameters, Virtual Temperature, Standard Atmosphere, Laws of thermodynamics, Entropy, Potential Temperature, Pseudo- adiabatic Process, Equivalent Temperature, Equivalent Potential Temperature, Claussius – Clapeyron Equation, Stability and Instability, Parcel Method and Slice Method, Entraiment in Cb clouds, Thermodynamic Diagram: p,α–diagram, Emagram, T -Øgram, Uses of thermodynamic diagrams, Precipitable Water Vapour, Rate of Precipitation, Stability indices, Role of Convective Available Potential Energy (CAPE) and Convective Inhibition Energy (CINE) in thunderstorm development

***Module 2*: (8 lectures)**

Thunderstorm: Basic requirements, Development mechanism, Life cycle of a thunderstorm cell, Movement of thunderstorm, Air-mass, Steady state thunderstorms, Ordinary Cell, Multi-cell Cluster, Super cell Thunderstorms.

Jet Stream - Definition, Classification of Jet Stream, Characteristics of Jet Stream, Jet Stream over Indian region and Seasonal Variation, Jet Stream and associated Aviation Weather Hazards.

Cloud Physics - General aspects of cloud and precipitation formation. Condensation Nuclei. Growth of water droplets. Microphysical properties of clouds. Bowen's Model. Growth by Condensation and Coalescence. Ice phase Nucleation, Ice Nuclei, Diffusion growth on Ice Nuclei, further growth by Accretion and Aggregation. Different types of precipitation processes including Bergeron Process and weather modification.

Atmospheric Electricity - Fair Weather Electric field of the atmosphere. Ions and Ionizing radiation, Conduction current, diurnal variation of electric field and conductivity. Thunderstorm electrification, its observation and theoretical aspects. Thunderstorm detection systems at airfields. Thunderstorm as a mechanism for maintaining the fair weather electric field.

***Module 3:* (4 lectures)**

Tropical cyclones: Classification of tropical disturbances, Global Distribution of Tropical Cyclones, Origin, Season and Frequency, Necessary conditions for tropical cyclone formation, intensity and land fall. Structure of tropical cyclone, The Eye, The Eye-Wall, Rain-bands, Name of cyclones, associated weather- gale wind, storm surge, heavy rainfall.

General Circulation: Energy Balance, Transport Process, Three Cell Model, ITCZ, Sub tropical highs, Trade winds, Westerlies, Polar easterlies.
Monsoon Condition- active and weak monsoon. EL-Nino, La-Nina, ENSO, Walker circulation and their effect on Indian monsoon.

***Module 4*: (4 lectures)**

Radar Meteorology - Application of Radar in Meteorology, characteristics of Radar Echoes, Doppler Radar, Radar Network and introduction to MST radar.

Satellite Meteorology- Polar orbiting and Geostationary satellites, Satellite systems: IRS and INSAT , Meteorological Images Multi-channel sensing, measurements of atmospheric temperature, humidity, CO, Ozone, Clouds, Soil temperature and moisture, sea surface temperature, sea waves, ocean bed topography, future prospects.

***Module 5*: (6 lectures)**

Aviation Weather Hazards – Definitions: Thunder Storm, Thundery Conditions, tornado, water spout, funnel cloud, Dust Storm, Dust Raising Winds, Smoke, Gust, Gustnadoes, gust-front, Gale, Squall, squall

lines, Icing, hail, ceiling and low cloud turbulence, down burst- microburst and macroburst, water ingestion, precipitation static.

Mid-Latitude Meteorology – Air Masses- definition and classification, Air mass modification, Stability of air mass, Fronts- definition- Types of fronts, Cold, Warm, Stationary and Occluded front, Frontal waves, frontal cyclone and occlusion, Warm front and Cold front occlusion, frontolysis and frontogenesis, Dryline. Extra-tropical cyclone and its comparison with tropical cyclone, Western Disturbances -their formation, movement and associated weather. Induced low, their formation, movement and associated weather.

***Module 6*: (2 lectures)**

Icing - Super-cooled water droplets, effect of icing on aircraft, structural icing- glaze, rime, mixed, pack, rain, hoar frost, freezing level, icing intensities. Induction and instrument icing, icing in clouds and ground icing.

***Module 7*: (4 lectures)**

Global Climatology - Global distribution of pressure and temperature at m.s.l. in winter and summer, distribution of annual rainfall and its variability, distribution of moisture and clouds. Vertical distribution of temperature. General circulation of atmosphere. Development of monsoons. Major categories of world climates.

Aeronautical Climatology - Airfield Weather Summary. Route Weather Summary (Indian). Route Weather Summary (Foreign).

***Module 8*: (14 lectures)**

Aircraft Observations and Reporting: Obligation of States, Aircraft observations, Routine Aircraft observations, Special Aircraft Observations and Reporting of Air reports.

Aviation Forecast – Forecast for Take-off and Landing. Trend type landing Forecast, Local Forecast, Area Forecast, ROFOR, WAFS, TAFs, GAMET, Reliability and accuracy of forecast.

Warnings - Cautionary Reports, Weather Warnings and Gale warnings,
Storm Warnings, Aerodrome Warnings; SIGMET, AIRMET, SNOWTAM and Wind Shear Warnings.

Flight Briefings and advices - Pre-flight information. Information at the time of briefing. In-flight Weather information. Post flight Weather information and Debriefs. VIP/VVIP Flight briefings. NOTAMs and SNOTAMs
Documentation including Chart form of documentation and WAFS and products from WAFS.

Operations of Aircraft - Meteorological requirements for different types of Aircraft and Air operations: Effect of Air density, Humidity, Turbulence and Winds on aircraft performance. Meteorology and Flight Safety.

Special Weather Phenomena - Jet streams. Clear Air Turbulence. Mountain waves. Icing Contrails. Dust haze/Dust raising winds. Fog/Mist/Haze. Definition: features and their effects on aviation.

Communication Network for exchange of aeronautical data.
ROBEX, VOLMET, D-VOLMET, ATIS, ACARs, AMDAR, Direct Reception System, internet use for meteorological briefing.

List of Practicals :

- **TYPE I : Nowcasting technique.**
- **TYPE II : Place Specific Objective forecasting techniques** – for
    - important Aviation Weather Hazards like Thunderstorm Dust
    - Storm, Squall, Poor Visibility (Fog, Mist,).
- **TYPE III : Area Forecast**: Preparation of enroute weather forecast for a
        - flight.
- **TYPE IV :** Exercises in issue of Weather warning; Cautionary Met report;

- Gale warning; SIGMET; Aerodrome warning.

Reference Books:

1. WMO Tech Notes on CAT, Mountain Waves, Icing, etc.
2. WMO Tech Note No 95 on Aeronautical Met.
3. Manual of Aeronautical Meteorological Practice by ICAO Doc 8896.
4. Meteorological Service for International Air Navigation by WMO- No.49 Volume II.
5. Essential of Meteorology: An invitation to the atmosphere by C. Donald Ahrens
6. Aviation weather by Peter Lester
7. Meteorology and Flight : A pilot's guide to weather by Tom A. M. Bradbury
8. Meteorology for pilot by Mike Wickson

Outcome after learning the course (Meteorology-1 and Meteorology-2):

1. Students will be highly skilled professional aviators who understand the International and national airspace system and can be utilized with all aspect of the air traffic control system used by Director General of Civil Aviation, Airport Authority of India and Airlines. Students will be able to plan a cross country flight with current data, print the developed flight log and demonstrate satisfactory knowledge about the elements of such a flight.

2. Students will develop communication skills and proficiency and will be able to apply these skills in the aviation environment. Students will be appointed in teams of two or four such that they will develop an oral presentation given to the class on an assigned weather chapter out of the textbook.

3. Students will recognize their responsibility to continue professional and personal development with an emphasis on diversity, ethics and teamwork. The assigned project to team members will be evaluated by classmates and the instructor and each team member will evaluate each other based on individual effort and teamwork performed within the team project.

4. Students will use appropriate aeronautical decision making based on meteorological conditions, human factors and safety.

Civil Air Requirements

Module 1: (15 Lectures)

Indian Aircraft Act 1934
Rules 1, 2, 8, 10, 11 & 12

Indian Aircraft Rules 1937
Part I – Extent & Definitions
Part II – General Flying Conditions
Rules – 4 to 20
Part III – General Safety Conditions
Rules – 21, 24, 24A, 24C
Part IV – Registration and marking of Aircraft Change in ownership
Rules – 33 & 34
Part V – Personnel of Aircraft
Rules – 38, 38 A(1) (a), 38 A(5), 38 A(6),38 A(7), 42 A & 47.

Module 2: (15 lectures)
Part VI – Airworthiness
Rules 52, 53 & 55
Part VII – Radio Telegraphic Apparatus
Rule 63
Schedule I – Prohibited Areas
Schedule II – Private Pilots Licence, Validity, Renewal & Privileges, General Requirements
Schedule III – Instrument Rating – Validity, Renewal & Privileges, General Requirements

Module 3: (15 lectures)
Schedule IV – Rules of the Air (Excluding water operations & Sea Planes)
Relevant Contents of Aeronautical Information publication
Relevant notices to Airmen
Aeronautical Information circular
Civil Aviation Requirements

REFERENCE BOOKS
TITLE PUBLISHER
1. Aviation Act 1934 Ministry of Civil Aviation
2. Indian Aircraft Rules Ministry of Civil Aviation
3. Aeronautical Information Publication Ministry of Civil Aviation
4. Aircraft Manual India

Soft Skills **[L : 3; T:--; P 2: -- (4 credits)]**

Detailed contents:

Module 1: (5 lectures)
What are soft skills, why are they important. Examples of soft skills, Examples of soft skills with videos.

Module 2: (15 lectures)
Knowing self, Knowing what others think about you. Understanding others, Johari Windows, Interpersonal skills, Team work, empathy, Emotional Quotient, giving and taking feedback.

Module 3: (20 lectures)
Communication Skills, Spoken and Written, Body language. Presentation Skills, how to prepare for a presentation, How to deliver an effective presentation, practical presentation.

Module 4: (10 lectures)
Written skills, Deciding on the objective, how to plan the report, how to research a topic, how to find important points, how to write effectively. How to quote references, Index, Bibliography.

Module 5: (5lectures)
Time and stress management.

Suggested Reference Books

1. Effective Communication by Keith Coleman
2. Writing without bullshit by Josh Burnoff
3. Assertiveness by Michael Hudson

Course Outcomes after the course the students will be able
. Understand their own personality
. Understand how to manage interpersonal relations effectively.
. Develop skills to deliver talks and presentations effectively.
. Develop written skills to write reports.

Laboratory - [L : 0; T:0 ; P :2 -- (1 credits)]
Suggested list of experiments from the following:

- Give a talk for 5 minutes extempore
- Give a long, prepared presentation
- Write and submit an essay.