Department of Technology
Savitribai Phule Pune University
(Formerly University of Pune)
Board of Studies, Aviation
Curriculum Structure for B.Tech Aviation 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	Navigation -1	4	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	**20**			
Semester -2						
6.	BAV201	Flight Dynamics	4	3		1
7.	BAV202	Meteorology-1	4	3	2	
8.	BAV203	Navigation-2	4	3		
9.	BAV204	AC Systems Mechanical	4	3		1
10.	BAV205	Mathematics	3	3		1
		Total	**19**			
Semester -3						
11.	BAV301	AC Systems-Electrical	4	3		1
12.	BAV302	Human Factors & Flight Safety	3	3		1
13.	BAV303	Aircraft Structures	2	2		
14.	BAV304	Meteorology-2	4	3	2	
15.	BAV305	Navigation-3	4			

		Total	**17**			
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			
20.	BAV702	Soft Skills	3			
21.	BAV703	DGCA Exams Preparation	10			
22	BAV704	Jet Propulsion	3			
		Total	**19**			
Semester -8						
23.	BAVFinProj	Final Project	20			
		Total	**20**			
Total Number of Credits for the course			**155**			

Semester – 1

Aerodynamics BAV101 [L:3;T:1;P:--] (4 Credits]

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, introduction to trans sonic and supersonic flight regimes.

Module 3: (12 lectures)
Airfoil, its geometry, flow over the airfoil, Pressure distribution, center 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, Effects of compressibility on Lift and drag, Introduction to Euler's eqn, High lift devices. Introduction to high-speedaerodynamics, trans-sonic and supersonic airflows and their characteristics

Module 7: (4 Lectures)
Propeller Theory, Generation of lift and drag, conversion to Thrust and Torque. Fine pitch and coarse pitch. Change of pitch in flight. 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

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BAV102
Navigation- 1 [L : 3 ; T : 1 ; P :--] (4 Credits)

Air Navigation
Module 1(28 Hours)

Direction,Latitude and Longitude, Great Circles,Rhumb Lines and Directions on the Earth, Convergency and Conversion Angle, Departure, Scale, Earth Magnetism, Direct Reading Compass, Aircraft Magnetism,
Nav Computer Slide Rule, Nav Computer Distance, Speed and Time Conversions, Nav Computer Tas and Altitude Conversions, Nav Computer the Triangle of Velocities, Nav Computer Wind Finding and Calculation of heading and Ground Speed, Multi-drift wind and Wind Components

Module 2 (20 hrs)
Flight Instrumentation

Aircraft Instrument Display, Pressure Heads, Air Temperature Measurements,
Air Speed Indicator
The Pressure Altimeter, Vertical Speed Indicator and AVSI, The Mach Meter

Module 3 (14 Hours)

Radio and Radar Aids
Introduction, VDF,NDB and ADF, VOR, ILS

BAV103
Avionics Technology Fundamentals [L: 3; T: --; P 0: 2] (4 credits)

Analog Electronics

Module 1: (**12 lectures**)
Semiconductor theory, Diodes, forward and reverse biasing of diode, application of diode Rectifier circuits and power supply
Bipolar Junction Transistors, Transistors Bios Circuits, CE, CB and CC configuration of transistor, Transistor operating region, Field Effect Transistors, Metal Oxide Semiconductor FETs.
Integrated Circuits

Module 2: (10 – Lectures)
Introduction to Amplifiers, Single stage and Multistage Amplifiers, AmplifierCharacteristics Feedbacks in Amplifiers, Introduction to sinusoidal Oscillators, Multivibrators (MVS), monostable, astable and bistable multivibrator circuits
Introduction to SCR (Silicon controlled rectifier), Power electronics, Thyristor, Light Activated SCR (LASCR), LED, photo diodes, photo-resistors, photo transmitters, Optoelectronics.

Digital Electronics
Module 3: (**12 lectures**)
Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Hexadecimal Number, Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra,
combinational logic systems, Representation of logic function, Basics of Flip flops,

Module 4: (12- lectures)

Introduction to digital logic families and characteristics of digital IC's TTL logic circuits, CMOS logic circuits, Registers, Counters, multiplexer, de-multiplexers, Adder Half and full adder circuits.
Fundamentals of microprocessor: Introduction of microprocessor, Architecture of microprocessor, System Buses, Other units of microprocessor, ALU, Program counter, memory system, instruction set, and programming language.

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 instruments 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.

BAV104
Introduction to Electrical and Instrument Fundamentals (Revised)
(L: 3, T: 0, P: 2 (4 Credits)

(Electromagnetism, Electrostatics, A.C fundamentals & circuits)

Module-1

Electromagnetism: (4 Hrs)

Magnetic effect of an electric current, right hand grip rule and cork screw rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of MMF, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series and parallel magnetic circuits, comparison of electrical and magnetic circuit, force on current carrying conductors placed in magnetic field, Fleming's left hand and right-hand rule. Faradays laws of electromagnetic induction, statically and dynamically induced emf, self and mutual inductance, energy stored in magnetic field. (No derivation).

Electrostatics: (2 Hrs)

Electrostatics field, electric flux density, electric field strength, absolute permittivity, relative permittivity, capacitance. Capacitors in series and parallel. Energy stored in capacitors, charging and discharging of capacitors and time constant (No derivation)

Module-2

A.C Fundamentals: (2 Hrs)

Sinusoidal voltages and currents, their mathematical and graphical representation. Concept of instantaneous, peak(maximum), average and rms. values, frequency, cycle, period, peak factor and form factor, phase difference ,lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor.
(No any derivation) (2 Hrs)

Single Phase AC Circuits:

Study of series R-L, R-C, R-L-C circuit and corresponding Phasor diagrams and voltage-current-power waveforms. Concept of active, reactive and apparent power and power factor. Concept of Impedance and power triangle. (2 Hrs)

Polyphase AC Circuits:

Concept of three-phase supply and phase sequence. Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. (2 Hrs)

Section 2 (Electrical Machines)

Module-3

Single Phase Transformers: (3 Hrs)
Construction, principle of working, EMF equation, voltage and current ratios. Losses, efficiency, and voltage regulation of transformer. Determination of these by direct loading method. Descriptive treatment of autotransformers.

D.C Machines: (3 Hrs)
Construction of DC machines. Working principal of DC generators and motors. EMF equation, concept of back EMF. Types of DC machines. Losses and efficiency of DC machines. Power stages. Characteristics of DC Motors. Speed control methods. Necessity of Starters. Three-point starter. Applications of DC motors.

Module-4 (3 Hrs)
Three phase Induction Motors: Construction, working principle and types of induction motors. Rotating magnetic field, synchronous speed, slip. Rotor circuit parameters (current, EMF, impedance, power). Torque of Induction motor. Condition for Maxtorque. Torque ratios. Torque-slip and Torque-Speed characteristic. Losses and efficiency of induction motor. Power stages. Starting methods. Speed control methods. Applications. (4 Hrs)
Single Phase motors: Construction and Working principle. Classifications. Split phase induction motors. Shaded pole motors. Applications. (Descriptive only) (2 Hrs)

Section 3 (Flight and Navigation Instruments)

Module-5 Transducers, Flight and Engine Instruments (6 Hrs)
Transducers. Resistive Transducers-Thermistors, RTD, Thermocouples and Strain Gauges. Inductive Transducers- Linear variable differential transformer (LVDT). Capacitive Transducers.
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-6 Navigation Instruments: (6 Hrs)
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 Glide scope indicator.

Laboratory -
Term work shall consist of a record of minimum eight exercises and experiments suggested as below:

1. To verify KCL and KVL
2. To verify Superposition theorem
3. To perform open circuit and short circuit test on a single-phase transformer.
4. To perform direct load test on single-phase transformer.
5. To measure three phase power by using two-wattmeter method.
6. Study of R-L-C series circuit

7. Verification of voltage and current relations in three phase balanced star and delta connected loads.
8. Study of safety precautions while working on electric installations and necessity of earthing.
9. Introduction to energy conservation and simple techniques to achieve it.
10. Study of various wiring components (Wires, Switches, Fuses, Sockets, Plugs, lamps, holders etc)

Suggested Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. C.R Dargan, "Electrical Technology" Dhanpatrai Publications
3. B.L Theraja "A textbook of Electrical Technology" S.chand and Company Ltd New Delhi
4. V.K.Mehta "Basic Electrical Engineering" S.chand and Company Ltd New Delhi.
5. A.K.Sawhney "A course in Electrical and Electronic Measurements and Instrumentation" Dhanpatrai and Company
6. G.Mandal, A.K. Datta "Electrical, Instruments& Radio" L.N.V.M. Society Group of Institutes, Dwarika,New Delhi.
7. IanMoir Allan & Seabridge "Aircraft Systems-Mechanical, electrical, and avionics subsystems integration" John Wiley & Sons Ltd.

Course Outcomes:

At the end of this course, students will be able to:

1. Understand and demonstrate the fundamentals of electromagnetism, electrostatics and A.C fundamentals.
2. Apply concept of electromagnetism for the working of single-phase transformers, A.C and D.C Machines.
3. Differentiate between electrical and magnetic circuits.
4. Draw phasor diagrams for single phase and three phase A.C circuits
5. Understand fundamentals of instrumentation and need for instruments.
6. Understand instrument commonly used in the cockpit: airplane instruments, navigation instruments and engine instruments.

BAV105

Radio and Radar Fundamentals Detailed contents: [L:3;T:--;P:2](4 Credits)

Module-1 **(7 lectures)**

Introduction to Radio Physics: Wave, Electromagnetic waves, Symbols of the international system of units, Phase, Polarization, The electromagnetic spectrum, Bandwidth, Frequencies

and channels, The atmosphere, Radio wave propagation, Interference, Understanding the Fresnel zone, Power

Module-2 **(10 Lectures)**

Fundamentals of telecommunications systems with focus on digital and wireless : Signal - (Analog, Digital, Random), Sampling, Bandwidth, spectrum, Noise, Interference, Channel Capacity, BER, Modulation- Analog (AM and FM) and Digital (ASK, FSK and PSK), Multiplexing (TDM, FDM), Introduction to spread spectrum-Pseudo-Random Noise sequence.

Module-3 **(7 lectures)**

Historical Overview of Radar, Basic Principle of Radar, Terminology of Radar Systems: Range, Pulse Repetition Frequency, Maximum Unambiguous Range, Minimum Range, Radar Range Equation: Standard Form of Radar Range Equation, Modified Forms of Radar Range Equation, Performance Factors: Minimum Detectable Signal, Receiver Noise, Figure of Merit

Module-4 **(8 lectures)**

Radar Systems - Types of Radars, Pulse Radar: Block Diagram of Pulse Radar, Doppler Effect, Derivation of Doppler Frequency, Continuous Wave Radar: Block Diagram of CW Radar, Frequency Modulated Continuous Wave Radar: Block Diagram of FMCW Radar, Tracking Radar: Angular Tracking- Sequential Lobbing, Conical Scanning, Classification of Radar Sets: Air defence Radars, Examples of battlefield Radar, Air Traffic Control (ATC) Radars, Radar Frequency Bands.

Module-5 **(8 lectures)**

Antenna Parameters: Directivity, Aperture Efficiency, Antenna Efficiency, Gain, Radar Antennas: Parabolic Reflector Antennas- Principle of Operation, Properties of Parabola, Construction & Working of a Parabolic Reflector, Lens Antennas: Construction & Working of Lens Antenna,

Suggested Reference Books

1. Radio Physics Course: An Elementary Text Which Explains the Principles of Electricity and Radio, Ghirardi, Alfred, Technical Division Murray Hill Books Inc, 2009
2. Bernard Sklar, “Digital Communications fundamentals and Applications”, Prentice Prof. Hall P T R, (2 nd Edition), 2009.
3. Introduction to Radar Systems, M. Skolnik, McGraw Hill, 3rd Edition, 2007
4. Radar Principles, Technology, Applications, B Edde, Prentice Hall, 1993

Semester –2

BAV201

Flight Dynamics **[L:3;T:1;P: --]** **(4 Credits)**

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.

Module-7: (8 Lectures)
Piston Engines: IC Engines, Combustion, Air Fuel Ratio, Thermodynamic system, Carnot Cycle, Efficiency, power output calculations, Detonation, hotspots, advancement and retardation. Systems: Spark ignition, Lubrication, Carburetion, Icing, fuel system, Cooling system. Parts of engine.

BAV202
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 gauges, 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/Specie ;
  - 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)

BAV203
Navigation- 2 [L : 3; T:0; P :2] (4 credits)

Air Navigation

Module 1 (24 hours)

Topo Maps and Map Reading, General Chart Properties Time, Mercator Chart Properties

Mercator Chart Scale, Lamberts Conformal Chart – 1, Lamberts Conformal Chart - 2
The Polar Stereographic Chart, Transverse Mercator and Oblique Mercator Chart
Time – 1, Time – 2, Time – 3, The Gridding of Charts

Flight Instrumentation
Module 2 (20 Hours)

Gyroscopes, Directional Gyro Indicator, The Aircraft Artificial Horizon and VGU
The Turn and Slip Indicator, Turn Co-Ordinator, The Remote Indicating Compass - The Slaved Gyro
The Inertial Navigation System, The Inertial Reference System, Air Data Computer, The Radio Altimeter

Radio and Radar Aids
Module 3 (10 hours)

MLS, Doppler, Radar Theory, Ground ATC Radars, Airborne Weather Radar

BAV204
Aircraft Systems - Mechanical [L: 3; T:1; P :0--] (4 credits)

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 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 Systems (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 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 airplanes. Typical layout of the Fuel systems for small airplanes. Important components, their function. Operating features of the system. Refueling and defueling, precautions, water content check.

Suggested Reference Books
(i) FAA Handbook of Hydraulic Systems. By Federal Aviation Administration
(ii) Aircraft 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 Aeroplan-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

BAV205
Mathematics

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

Module 1: (13 lectures)
Multivariable Calculus: Differentiation
Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points.

Module 2: (05 lectures)
Sequences and Series
Convergence of sequence and series, tests for convergence, power series, Taylor's series.

Module 3: (10 lectures)

Multivariable Calculus: Integration (7 hours)

Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities)..

***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

Semester-3

BAV 301

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

Course Contents:

Section-1
(Electromagnetism, Electrostatics, A.C fundamentals & circuits)

Module-1

Electromagnetism: (4 Hrs)

Magnetic effect of an electric current, right hand grip rule and cork screw rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of MMF, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series and parallel magnetic circuits, comparison of electrical and magnetic circuit, force on current carrying conductors placed in magnetic field, Fleming's left hand and right-hand rule. Faradays laws of electromagnetic induction, statically and dynamically induced emf, self and mutual inductance, energy stored in magnetic field. (No derivation).

Electrostatics: (2 Hrs)

Electrostatics field, electric flux density, electric field strength, absolute permittivity, relative permittivity, capacitance. Capacitors in series and parallel. Energy stored in capacitors, charging and discharging of capacitors and time constant (No derivation)

Module-2

A.C Fundamentals:

Sinusoidal voltages and currents, their mathematical and graphical representation. Concept of instantaneous, peak(maximum), average and rms. values, frequency, cycle, period, peak factor and form factor, phase difference,lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. (2 Hrs

Single Phase AC Circuits:

Study of series R-L, R-C, R-L-C circuit and corresponding Phasor diagrams and voltage-current-power waveforms. Concept of active, reactive and apparent power and power factor. Concept of Impedance and power triangle.

(2 Hrs)

Polyphase AC Circuits:

Concept of three-phase supply and phase sequence. Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams.

(2 Hrs)

Section 2 (Electrical Machines)

Module-3

Single Phase Transformers:

Construction, principle of working, EMF equation, voltage and current ratios. Losses, efficiency, and voltage regulation of transformer. Determination of these by direct loading method. Descriptive treatment of autotransformers. (3Hrs)

D.C Machines:
Construction of DC machines. Working principal of DC generators and motors. EMF equation, concept of back EMF. Types of DC machines. Losses and efficiency of DC machines. Power stages. Characteristics of DC Motors. Speed control methods. Necessity of Starters. Three-point starter. Applications of DC motors.

(3 Hrs)

Module-4

Three phase Induction Motors: Construction, working principle and types of induction motors. Rotating magnetic field, synchronous speed, slip. Rotor circuit parameters (current, EMF, impedance, power). Torque of Induction motor. Condition for Maxtorque. Torque ratios. Torque-slip and Torque-Speed characteristic. Losses and efficiency of induction motor. Power stages. Starting methods. Speed control methods. Applications. (4 Hrs)

Single Phase motors: Construction and Working principle. Classifications. Split phase induction motors. Shaded pole motors. Applications. (Descriptive only) (2 Hrs)

Section 3 (Flight and Navigation Instruments)

Module-5

Transducers, Flight and Engine Instruments (6 Hrs)

Transducers. Resistive Transducers-Thermistors, RTD, Thermocouples and Strain Gauges.Inductive Transducers- Linear variable differential transformer (LVDT). Capacitive Transducers.

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-6

Navigation Instruments: (6Hrs)

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 Glide scope indicator.

Laboratory -

Term work shall consist of a record of minimum eight exercises and experiments suggested as below:

11. To verify KCL and KVL
12. To verify Superposition theorem

13. To perform open circuit and short circuit test on a single-phase transformer.
14. To perform direct load test on single-phase transformer.
15. To measure three phase power by using two-wattmeter method.
16. Study of R-L-C series circuit
17. Verification of voltage and current relations in three phase balanced star and delta connected loads.
18. Study of safety precautions while working on electric installations and necessity of earthing.
19. Introduction to energy conservation and simple techniques to achieve it.
20. Study of various wiring components (Wires, Switches, Fuses, Sockets, Plugs, lamps, holders etc)

Suggested Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. C.R Dargan, "Electrical Technology" Dhanpatrai Publications
3. B.L Theraja "A textbook of Electrical Technology" S.chand and Company Ltd New Delhi
4. V.K.Mehta "Basic Electrical Engineering" S.chand and Company Ltd New Delhi.
5. A.K.Sawhney "A course in Electrical and Electronic Measurements and Instrumentation" Dhanpatrai and Company
6. G.Mandal, A.K. Datta "Electrical, Instruments& Radio" L.N.V.M. Society Group of Institutes, Dwarika,New Delhi.
7. IanMoir Allan & Seabridge "Aircraft Systems-Mechanical, electrical, and avionics subsystems integration" John Wiley & Sons Ltd.

BAV302

Human Factors and Flight Safety

HUMAN PERFORMANCE

Module 1 **(5 Hours)**

HUMAN FACTORS: BASIC CONCEPTS, Human factors in aviation, Becoming a competent pilot Accident statistics, Flight safety concepts, Error Management (TEM) mode.Safety culture.

Basics of flight physiology, Respiratory and circulatory system,
Decompression sickness/illness, normal range of cabin pressure altitude in pressurised commercial aircraft,

Acceleration, 'linear', 'angular' and 'radial acceleration' the effects of acceleration on the circulation and blood volume distribution, the factors determining the effects of Acceleration on the human body,

High-altitude environment,
Ozone, the possible harmful effects of ozone. Radiation, Humidity,Extreme temperatures

Module 2 **(6 Hours)**
Man and Environment:
the sensory system
Central, peripheral and autonomic nervous systems 'Habituation' and its implication for flight safety.

Vision
Functional anatomy, Distinguish between the functions of the rod and Cone cells.Visual foveal and peripheral vision, limitations of night vision and the different Scanning techniques by both night and day, adaptation mechanism in vision to cater for reduced and increased levels of illumination. Binocular and monocular vision

Hearing
Descriptive and functional anatomy, Audible range of the human ear, the basic functions of the different parts of the auditory system.

Equilibrium
The causes of motion sickness, necessary actions to be taken to counteract the symptoms of motion sickness.**Integration of sensory inputs**
Constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, auto kinesis, vectional false horizons, and surface planes. Experienced in flight and identify the danger, Attached to them.

Module 3 **(5 Hours)**

Health and hygiene

Personal hygiene, role of personal hygiene as a factor in Human performance.

Body rhythm and sleep, internal body rhythms and their relevance to sleep. 'Circadian rhythm'. , interactive effects of circadian rhythm and vigilance on a pilot's performance during flight, as the duty day elapses.

Module 4 **(6 Hours)**

Problem areas for pilots

Common minor ailments
Gastrointestinal upsets, Obesity, Mass Index (BMI). problems associated with Type 2 (mostly adult) diabetes. Back pain, good sitting posture;lumbar support; good physical condition.

Food hygiene
Tropical climates, problems associated with operating in Tropical climates.
Infectious diseases, Preventative hygienic measures,
Vaccinations, drugs and other measures reduce the, Chances of catching these diseases.

Intoxication
Tobacco, Caffeine, Alcohol
Drugs and self-medication, dangers associated with the use of nonprescription Drugs.

Incapacitation in flight
List the major causes of in-flight incapacitation.

BASIC AVIATION PSYCHOLOGY

Human information processing, Attention and vigilance

Module 5 **(6 Hours)**

Perception
Basis of the perceptual process

Memory
The link between the types of memory (to include sensory, working/short-term and long-term memories).

Response selection

Learning principles and techniques
Distinguish between the following basic forms of learning:, classical and operant conditioning (behaviouristic approach); learning by insight (cognitive approach); Learning by imitating (modeling).
Rasmussen model which describes the guidance of a pilot's behaviour in different situations.
Phases in connection with the Acquisition of automated behavior, cognitive phase; associative phase; automatic phase.

Motivation
Influences of different levels of motivation on performance taking into consideration Task difficulty.

Human error and reliability

Module 6 **(6 Hours)**

Reliability of human behaviour
The factors which influence human reliability.

Mental models and situation awareness
'Situation awareness'. Cues which indicate loss of situation awareness and name the steps to regain it.
Factors which influence one's situation awareness both positively and negatively, and stress
The importance of situation awareness in the context of flight safety. 'Mental model' in relation to a surrounding complex situation.

Theory and model of human error
The 'error chain'. O Differentiate between an isolated error and an error chain. Main forms/types of errors, slips, faults, omissions and violations. The above errors and their relevance in flight

Error generation
Distinguish between internal and external factors in error generation. The three main sources of external error, generation in the cockpit. Ergonomics, economics, social environment. The major goals in the design of human centred man–machine interfaces.

Decision-making

Module 7 **(5 Hours)**

Decision-making concepts
'Deciding' and 'decision-making', the major factors on which decision-making Should be based during the course of a flight. The nature of bias and its influence on the decision-making process. Definition of the aim; collection of information; risk assessment; development of options; Evaluation of options; decision; implementation; consequences; review and feedback.

Module 8 **(6 Hours)**

Avoiding and managing errors: cockpit management
Safety awareness need for being aware of not only one's own performance but that of others before and
During a flight and the possible consequences and/or risks.

Coordination (multi-crew concepts), objectives of the multi-crew concept
Cooperation advantages and disadvantages of team work. 'Synergy' cohesion' 'groupthink'

LO Explain how behaviour can be affected by the Following factors: persuasion, conformity, compliance, obedience. Inherent dangers of a situation where there is a mix of role and status within the cockpit.
'Leadership' and 'followership'

Communication
'information', 'communication'. Verbal and non-verbal communication.

Module 9 **(5 Hours)**

Human behavior, personality, attitude and behaviour
Factors which determine an individual's behaviour. Distinguish between 'personality', 'attitude' and 'behaviour'.
Individual differences in personality and motivation
Identification of hazardous attitudes (error proneness)
Examples of attitudes and behavior (including their signs) which, if prevalent in a crew member, might represent a hazard to flight safety.

Human overload and under load

Arousal Describe the relationship between arousal and performance. Under load
Stress 'Homeostasis' 'stress' and why stress is a natural human reaction. Physiological response to stress is generated by the 'fight or flight' response. Factors influencing the tolerance of stressors relationship between stress and anxiety. The effects of anxiety on human performance.The general effect of chronic stress on the
Human system.Stress is cumulative and how stress from one situation can be transferred to a different
Situation. Effect of human under load/overload on effectiveness in the cockpit.

Fatigue and stress management
'Fatigue' and differentiate between the two types of fatigue.symptoms and describe the effects of
Fatigue. Methods of stress management.

Module 10 **(6 Hours)**

Advanced cockpit automation Advantages and disadvantages
Basic concept of automation, the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situation awareness and crew, coordination.

Automation complacencymain weaknesses in the monitoring of automatic systems.

Working concepts, influence of automation on crew communication and describe the potential Disadvantages. The role of automation with respect to flight safety

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.

BAV303
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

BAV304

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.

BAV305

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

Air Navigation

Module 1(24 Hours)

The Critical Point, The Point Of No Return, The 1 in 60 Rule, Nav using 1 in 60 Rule
The Other Applications of 1 in 60 Rule, Flight and Fuel Planning of Climb, Cruise and Descent Fuel Efficiency, Conversion Lbs, Kg, Ltrs ,IMPG and USG. Loading and C of G Calculations Payload Calculations, Filing Of ATC Clearance, General Navigation Problems

Flight Instrumentation

Module 2 (18 Hours)

FMS, EFIS, Flight Warning System, Aerodynamic Warnings
GPWS, CAS / TCAS, FDR, CVR

Radio and Radar Aids

Module 3 (12 Hours)

Secondary Surveillance Radar, DME, Area Navigation, Global Navigation System

Semester-7

BAV701 **[L : 2; T:0; P :2 --] (3 credits)**

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

BAV702

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.

BAV704

Jet Propulsion

Module 1 (10 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: (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.

Module 3: (15 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

Module 4: (10 Lectures)

Fuel system, Fuel – mixture, detonation, pre-ignition, octane rating, fuel additives, Fuel quality, fuel quality control.

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