NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION, ACCREDITED BY NBA (AICTE) NEW DELHI)

COURSE CONTENT, SCHEME OF TEACHING AND EXAMINATION-2013-14

Aeronautical Engineering

III- VIII SEMESTER

SEMESTER: III

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	13MAT31	ENGINEERING MATHEMATICS –III	Mathematics	3	2	-	50	50	100	4
2	**13AE32**	**ELEMENTS OF AERONAUTICS**	AE	4	-	-	50	50	100	4
3	13AE33	BASIC THERMODYNAMICS	AE/ME	3	2	-	50	50	100	4
4	13AE34	MECHANICS OF MATERIALS	AE/ME	3	2	-	50	50	100	4
5	13AE35	MANUFACTURING TECHNOLOGY	AE/ME	2	2	-	50	50	100	3
6	**13AE36**	**ENGINEERING METROLOGY AND MEASUREMENTS**	AE/ME	2	2	-	50	50	100	3
7	13AEL37	METROLOGY AND MEASUREMENTS LAB	AE/ME	-	-	3	50	50	100	1.5
8	13AEL38	MACHINE SHOP LAB	AE/ME	-	-	3	50	50	100	1.5
						TOTAL	400	400	800	25

SEMESTER: IV

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	13MAT41	ENGINEERING MATHEMATICS –IV	Mathematics	3	2	-	50	50	100	4
2	13AE42	APPLIED THERMODYNAMICS	AE/ME	3	2	-	50	50	100	4
3	**13AE43**	**THEORY OF MACHINES**	AE	3	2	-	50	50	100	4
4	**13AE44**	**FLUID MECHANICS**	AE	2	2	-	50	50	100	**3**
5	**13AE45**	**MATERIAL SCIENCE**	AE	2	2	-	50	50	100	**3**
6	**13AE46**	COMPUTER AIDED MACHINE DRAWING	AE	2	-	3	50	50	100	**3**
7	**13AE47**	**AIRCRAFT SYSTEMS**	**AE**	**3**		**-**	**50**	**50**	**100**	**3**
8	13AEL48	MATERIAL TESTING LAB	AE	-	-	3	50	50	100	1.5
9	13AEL49	FOUNDRY AND FORGING LAB	AE	-	-	3	50	50	100	1.5
						TOTAL	450	450	900	27

Continuous Internal Evaluation** * Semester End Examination** **# L- Lecture, T- Tutorial, P- Practical**

SEMESTER: V

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	13AEH51	Management and Entrepreneurship	AE	3	-	-	50	50	100	3
2	**13AE52**	**Aircraft Electrical System**	**AE**	**2**	**2**	**-**	**50**	**50**	**100**	**3**
3	13AE53	Aircraft Structures – I	AE	3	2	-	50	50	100	4
4	13AE54	Aerodynamics – I	AE	3	2	-	50	50	100	4
5	13AE55	Aircraft Propulsion	AE	3	2	-	50	50	100	4
6	13AEE56X	Elective (Group A)	AE	4	-	-	50	50	100	**4**
7	13AEL57	Aerodynamics Laboratory	AE	-	-	3	50	50	100	1.5
8	13AEL58	Energy Conversion Laboratory	AE	-	-	3	50	50	100	1.5
						TOTAL	400	400	800	25

SEMESTER: VI

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	13AE61	Applied Gas Dynamics	AE	3	2	-	50	50	100	4
2	13AE62	Aircraft Performance	AE	3	2	-	50	50	100	4
3	13AE63	Aerodynamics – II	AE	3	2	-	50	50	100	4
4	**13AE64**	**Aircraft Instruments**	**AE**	**2**	**2**	**-**	**50**	**50**	**100**	**3**
5	13AEE65X	Elective (Group B)	AE/ME	3	2	-	50	50	100	4
6	13AEO66X	Open Elective (Group C)	AE/ME	3	-		50	50	100	3
7	13AEL67	Structures Laboratory	AE	-	-	3	50	50	100	1.5
8	13AEL68	Propulsion Laboratory	AE	-		3	50	50	100	1.5
						TOTAL	450	450	900	25

Continuous Internal Evaluation** * Semester End Examination** **# L- Lecture, T- Tutorial, P- Practical**

SEMESTER: VII

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	13AE71	Control Engineering	AE	3	2	-	50	50	100	4
2	13AE72	Aircraft Structures - II	AE	3	2	-	50	50	100	4
3	13AE73	Aircraft Stability & Control	AE	2	2	-	50	50	100	3
4	13AE74	Gas Turbine / Technology	AE	4	-	-	50	50	100	4
5	13AEE75X	Electives (Group D)	AE	4	-	-	50	50	100	4
6	13AEO76X	Open Electives (Group E)	AE	3	-	-	50	50	100	3
7	13AEL77	Design, Modeling and Analysis Laboratory	AE	-	-	3	50	50	100	1.5
8	13AEL78	Simulation Laboratory	AE	-	-	3	50	50	100	1.5
9	13AEP79	Project preliminaries and Technical Seminars	AE	-	1	-	-	-	-	-
						TOTAL	400	400	800	25

SEMESTER: VIII

Sl No	Subject Code	Subject Name	Teaching Dept.	Teaching Hours/week			Examination			Credits
				L#	T#	P#	CIE*	SEE**	Total	
1	**13AEH81**	**Operations Management**	**AE**	**3**	**-**	**-**	**50**	**50**	**100**	**3**
2	**13AE82**	**Aircraft Radar System**	**AE**	**2**	**2**	**-**	**50**	**50**	**100**	**3**
3	13AEE83X	Elective (Group F)	AE	4	-	-	50	50	100	4
4	13AEP84	Project Work	AE	-	-	-	100	100	200	13
5	13AEP85	Mini Project/Internship/Self Study	AE	-	-	-	50	50	100	2
6	13AEP85	Seminars on current topics	AE	-	-	3	-	-	-	-
						TOTAL	200	200	400	25

Continuous Internal Evaluation** * Semester End Examination** **# L- Lecture, T- Tutorial, P- Practical**

Elective Group A **Credits 4**

Sl. No.	Subject Code	Subject Name
1.	13AEE561	Theory of Elasticity
2.	13AEE562	Internal Combustion Engines
3.	13AEE563	Non Traditional Machining
4.	13AEE564	Industrial Engineering & Management
5.	13AEE565	Turbo-machinery
6.	13AEE566	Cryogenics

Elective Group B **Credits 4**

Sl. No.	Subject Code	Subject Name
1.	13AEE651	Theory of Plasticity & Metal Forming Processes
2.	13AEE652	Refrigeration & Air conditioning
3.	13AEE653	Finite Element Methods
4.	13AEE654	Energy Engineering
5.	13AEE655	Automotive Engineering
6.	13AEE656	Welding Technology

Elective Group C (Open Elective) **Credits 3**

Sl. No.	Subject Code	Subject Name
1.	13AEO661	Numerical Methods
2.	13AEO662	MEMS
3.	13AEO663	Organizational Behavior
4.	13AEO664	TQM
5.	13AEO665	Essential Information System
6.	13AEO666	Solar energy

Elective Group D **Credits 4**

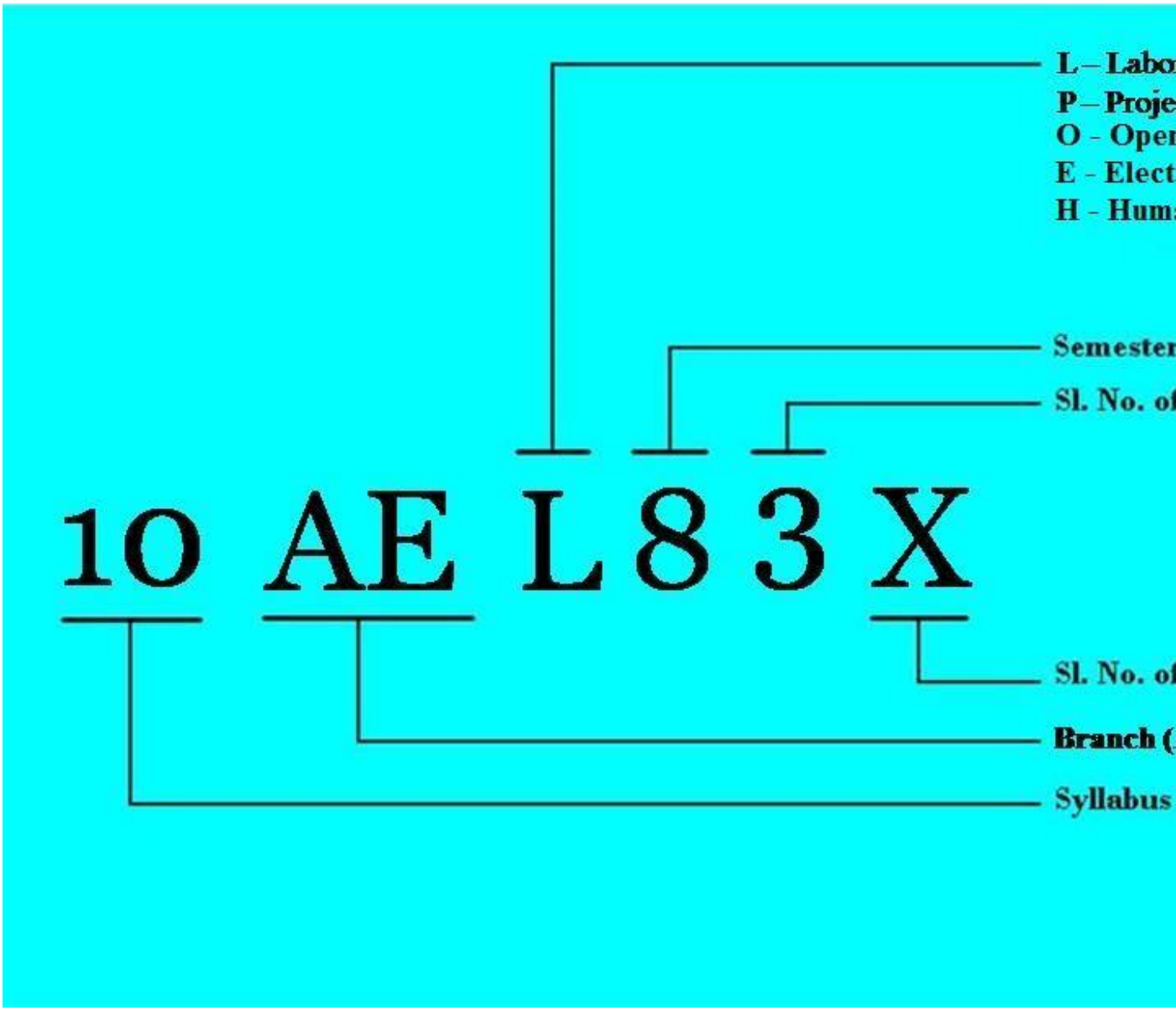
Sl. No.	Subject Code	Subject Name
1.	13AEE751	Smart Materials
2.	13AEE752	Tribology
3.	13AEE753	Statistical Quality Control
4.	13AEE754	Introduction to Composite Materials
5.	13AEE755	Renewable Energy resources
6.	13AEE756	Flight Testing

Elective Group E (open Elective) **Credits 3**

Sl. No.	Subject Code	Subject Name
1.	13AEO761	Computer Graphics
2.	13AEO762	Nano Technology
3.	13AEO763	Management Information System
4.	13AEO764	Project Management
5.	13AEO765	Non Destructive Testing
6.	13AEO766	Computational Fluid Dynamics

Elective Group F **Credits 4**

Sl. No.	Subject Code	Subject Name
1.	13AEE831	Experimental Stress Analysis
2.	13AEE832	Machine Tool design
3.	13AEE833	Foundry Technology
4.	13AEE834	Bio Mass Energy System
5.	13AEE835	Computer Integrated Manufacturing
6.	13AEE836	Aircraft Communication System



SEMESTER III ENGINEERING

MATHEMATICS III

Sub Code :	**13MAT31**	**Credits :**	**04**
Hours/Week :	**3+2+0**	**CIE Marks :**	**50**
Total Hours :	**48**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Convergence and divergence of infinite series of positive terms, definition and illustrative examples. Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. 10 h

UNIT II

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms. 09 h

UNIT III

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace? equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'lembert solution of one dimensional wave equation. 09 h

UNIT IV

Curve fitting by the method of least squares- Fitting of curves of the form y=ax+b; y=ax2+bx+c; y=aebx; y=axb Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method. 10 h

UNIT V

Linear algebra: Elementary row transformation, echelon form, Rank of a matrix, Consistency of linear system of equation, Gauss elimination, Gauss Siedel methods, Eigen values and Eigen vectors, Largest Eigen value by Power method.
Numerical analysis: Solution of algebraic and transcendental equations by regula-falsi method and Newton-Raphson methods
Evaluation of derivatives using Newton's forward and backward difference interpolation formulae,
Numerical Integration by Trapezoidal, Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule, Weddle's rule. 10 h

Text Book

1. "**Higher Engineering Mathematics**" by Grewal, 36th edition, Khanna Publication.

Reference Books

1. Advanced Engg Mathematics by Erwin E Kreyzig, 8th edition, Wiley

ELEMENTS OF AERONAUTICS

Subject code	**: 13AE32**	**Credits**	**: 04**
Hours/week	**: 4+0+0**	**CIE marks**	**: 50**
Total hours	**: 48**	**SEE marks**	**: 50**
Exam Hours	**: 03**		

UNIT I

Aircraft Industry Overview

Evolution and History of flight, types of aerospace Industry, key players in aerospace Industry, Aerospace manufacturing, industry supply chain, prime contractors, tier 1 suppliers, key challenges in industry supply chain, OEM supply chain strategies, Mergers and acquisitions, Aerospace industry trends, advances in Engineering/ CAD/CAM/CAE tools and materials technology, global and Indian Aircraft scenario.

Introduction to Aircraft

Basic components of an aircraft, structural members, aircraft axes system, aircraft motions, control surfaces and high lift devices.

Types of Aircraft- Lighter than air/ heavier than air aircraft. Conventional design configurations based on power plant location, wing location, intake location, tail unit arrangements, landing gear arrangements. Unconventional configurations- Biplane, variable sweep, canard layout, twin boom layouts, span loaders, blended body wing layout, STOL and STOVL aircraft, stealth aircraft. Advantages and disadvantages of these configurations. **10 h**

UNIT II & III

Introduction to Aircraft Systems

Types of Aircraft Systems. Mechanical systems. Electrical and Electronics systems. Auxiliary systems.

Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, hydraulic systems, Fuel systems, Landing gear systems, Engine Control systems, Ice and rain protection systems, Cabin pressurization and air conditioning systems, steering and brakes systems auxiliary power unit,

Electrical systems: avionics, Flight controls, Autopilot and Flight management systems, Navigation systems, Communication, Information systems Rader system **18 h**

UNIT IV

Basic Principles of Flight

Significance of speed of Sound, Air speed and ground speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching Moments, Types of Drag, Lift curve, Drag Curve, Lift/ Drag Ratio Curve, Factors affecting lift and drag, Center of pressure and its effects.

Aerofoil Nomenclature, Types of Aerofoil, Wing section- Aerodynamic Center, Aspect Ratio, Effects of lift, drag speed, air density on drag. **10 h**

UNIT V

Basics of Flight Mechanics

Mach waves, Mach angles, sonic and Supersonic Flight and its effects

Stability and Control

Degree of stability- Lateral, Longitudinal and Directional stability and controls of Aircraft. Effects of flaps and Slats on Lift Coefficients, Control tabs, stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves

Aircraft Performance and Maneuvers

Power Curves, Maximum and minimum speeds of horizontal flight, effects of changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a aeroplane during a turn, loads during a turn, correct and incorrect angles of bank, aerobatics, inverted Maneuvers, manoeuvrability. **10 h**

Text Books

1. Flight without Formulae by A.C Kermode, Pearson Education, 10th Edition
2. Mechanics of Flight by A.C Kermode, Pearson Education, 5th Edition

Reference

1. Fundamentals of Flight, Shevell, Pearson Education, 2nd Edition
2. Introduction to Flight by Dave Anderson
3. Aircraft systems: Mechanical, Electrical and Avionics subsystems integration by Ian moir, Allen Seabridge

BASIC THERMODYNAMICS

Sub Code :	**13AE33**	**Credits :**	**04**
Hours/Week :	**3+2+0**	**CIE Marks :**	**50**
Total Hours :	**48**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Basic Concepts And Definitions: Thermodynamics-definition and scope, Engineering thermodynamics definition, applications of engineering thermodynamics, macroscopic and microscopic approaches, system; types-open, closed, isolated, homogeneous and heterogeneous systems, control volume; thermodynamic properties; definition, types-intensive and extensive properties, thermodynamic state; state point, state diagram, path and process; quasistatic process, cyclic and noncyclic processes, thermodynamic equilibrium; definition, thermal, mechanical and chemical equilibriums, adiabatic and diathermic walls; temperature concept, Zeroth law of thermodynamics, temperature measurement, international fixed points, scales, problems on temperature scales.

Work And Heat: Definition of work in mechanics and its limitations; thermodynamic definition of work; examples, sign convention, displacement work; displacement work for various thermodynamic processes through P-V diagrams, other forms of work; shaft work, electrical work, magnitisation work, surface tension work, stretching work, flow work, heat; definition, units, sign convention, heat and work path functions, similarities and dissimilarities, problems. 10 h

UNIT II

First Law Of Thermodynamics:

Joule's experiment, equivalence if heat and work, statement of first law of thermodynamics applied to cyclic and non-cyclic processes, PMMK I, energy as a property, modes of energy, enthalpy, specific heat; definition, specific heat at constant pressure and constant volume, particular and universal gas constants, first law applied to thermodynamics processes, problems.

Extension of first law to control volume, steady flow energy equation; applications, unsteady processes: filling and evacuation of vessels, problems. 10 h

UNIT III

Second Law Of Thermodynamics:

Limitations of first law of thermodynamics, thermodynamic cycle, mechanical cycle, Devices converting heat to work in thermodynamic and mechanical cycles, heat engine, Devices converting work into heat in thermodynamic cycle, heat pump, cop, reversed heat engine, Kelvin-Planck and Clausius staments of II law of thermodynamics, PMMKII, Equivalence of two statements, reversible and irreversible processes, factors that make processes irreversible, Carnot cycle, corollaries of Carnot theorem, thermodynamic and absolute temperature scales, problems.

Entropy:

Clasius inequality, Clausius theorem, entropy: definition, a property, principle of increase of entropy, change in entropy for various thermodynamics, problems. 09 h

UNIT IV

Availabilty And Irreversibility:

Available and unavailable energy, maximum work, maximum useful work for a system and control volume, availability of a system and steady flow system, irreversibility, second law efficiency, problems.

Ideal And Real Gases:

Equation of state, perfect and semi perfect gases, evaluation of heat, work, dE, dH, dS for various thermodynamic processes, ideal gas mixture, Dalton's law of partial pressures, Amagat's law of additive volumes, evaluation of properties, analysis of various processes

Real gases; Vander Waal's equation and its constants in critical properties, law of corresponding states, compressibility factor, compressibility chart, problems. 09 h

UNIT V

Pure Substances:

Pure substance; definition, two property rule, vapour formation; P-V, P-T, P V T diagrams, critical and triple points, T-S and H-S diagrams, steam tables, dryness fraction, problems.

Vapor processes; evaluation of W, dE, Q, dH for various processes, problems.

Steam calorimeters; separating, throttling and combined calorimeters, problems. 10 h

Text Book

1. **"Basic and applied thermodynamics"**, P.K. Nag, Tata McGraw Hill.
2. **"Thermodynamics an engineering approach"**, Yunus A Cenegal, Tata McGraw Hill.
3. **"Thermal Engineering"** Rajput, Laxmi Publications.

Reference Books

1. **"Engineering Thermodynamics"**, J B Jones, G A Hawkins, John Wiley and Sons.
2. **"Thermodynamics", S C Gupta**, Pearson Edu. Pvt Ltd.
3. **"Basic applied thermodynamics"** , Omakar Singh

MECHANICS OF MATERIALS

Sub Code :	**13AE34**	**Credits :**	**04**
Hours/Week :	**3+2+0**	**CIE Marks :**	**50**
Total Hours :	**48**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Stresses and Strains:

Introduction to Stress, Types of stress, Strain, Types of Strain, Modulus of Elasticity, True Stress, True Strain, Simple problems, Stress Strain Diagram of Ductile, Brittle, Visco-Elastic, Linear & Non-linear Elastic materials, Bars with varying sections, Bars of composite sections, Simple problems, Thermal stresses, Simple problems, Elastic constants and its relation, volumetric stains, Simple problems.

Compound Stresses:

Methods of Determining stresses in oblique sections, Principal planes and stresses, Simple problems, Construction of Mohr's circle, simple problems. 10 h

UNIT II

Shear Force and Bending Moment Diagram:

Introduction to shear force, Bending moment, Types of Beams and loads, Sign convention for shear force and bending moment, Shear force and bending moment diagram for various beams. Relation between shear force and bending moment. 10 h

UNIT III

Bending Stresses and shear stress in Beams:

Introduction, Pure Bending and Simple Bending, Expression of Bending stress, Neutral axis and Moment of resistance, Bending stress in symmetrical sections, Section modulus, Section modulus for various shapes of the beam section. Introduction to shear stress, shear stress distribution for different section.09 h

UNIT IV

Deflection of Beams:

Introduction to Deflection and slope, Finding Deflection and slope of a beam subjected to various loads, Relation between slope, Deflection and radius of curvature, Simple problems to be solved for the beams experiencing various loads

Torsion of Shafts:

Introduction to torsion, Derivation of shear stress produced in a circular shaft subjected to Torsion, Expression of Torque in terms of polar moment of Inertia, Power transmitted by shaft, simple problem.09 h

UNIT V

Column and struts:

Introduction to columns and struts, Failure of a column, Expression of crippling load when (a) both ends are hinged (b) One end of the column is fixed and the other end is free (c) both ends are fixed (d) One end is fixed and the other end is hinged. Simple problems to be solved used Euler's formula and Rankine formula

Theory of Failures:

Theories of failure: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, Maximum strain energy theory, Maximum shear strain Energy theory. Graphical representation of theories for two dimensional stress system(No problems).

Thick and Thin cylinders

Thin cylinders subjected to internal pressure. Stresses in a thin cylinder subjected to internal pressure, Expression of circumferential stress and hoop stress, Simple problems

Thick Cylinder: Lame's theorem, Stresses in a thick cylinder, Simple problems to be solved.

10 h

Text Book

1. " **Strength of Materials**", Ramamrutham,Vikas Publication,New Delhi

Reference Books

1. "**Strength of Materials**", R K Bansal, Laxmi Publication Pvt Ltd., New Delhi.

MANUFACTURING TECHNOLOGY

Sub Code :13AE35 **Credits : 03**
Hours/Week :2+2+0 **CIE MARKS : 50**
Total Hours :36 **SEE MARKS : 50**
Exam Hours :03

UNIT I

Casting Process: Introduction, Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Advantages & Limitations of casting process.
Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns. **Binder**:
Definition, Types of binder used in moulding sand. **Additives**:
Need, Types of additives used and their properties.
Sand Molding: Types of base sand, requirement of base sand. Molding sand mixture ingredients for different sand mixtures. Method used for sand molding, such as Green sand, dry sand and skin dried moulds.
Cores: Definition, Need, Types. Method of making cores, Binders used, core sand molding.
Concept of Gating & Risers. Principle and types. 0**7 h**

UNIT II

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.
Moulding Machines: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.
Special molding Process: Study of important molding processes, No bake moulds, Flaskless moulds, Sweep mould, CO_2 mould, Shell mould, Investment mould
Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.
Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace. **07 h**

UNIT III

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, Shear angle relationship, problems on Merchant's analysis. Tool Wear and Tool failure, Tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.
Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics.
Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature. **07 h**

UNIT IV

Turret and Capstan Lathe, Shaping and Planing Machines: Classification, constructional features of. Shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations .
Broaching process -Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.
Finishing and other Processes Lapping and Honing operations –Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application. **08 h**

UNIT V

Non-traditional machining processes: Need for nontraditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jetmachining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining **07 h**

TEXT BOOKS:
1. **"Workshop Technology", Hazara Choudhry,** Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. "**A Textbook Manufacturing Technology-I & II",** Dr P C Sharma, S CHAND & Company publications, 2008
REFERENCE BOOKS:
1. "**Manufacturing Science**", Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. "**Fundamentals of Metal Machining and Machine Tools"**, G. Boothroyd, McGraw Hill, 2000.
3. "**Production Technology",** R.K.Jain, Khanna Publications, 2003
4. **"Manufacturing & Technology: Foundry Forming and Welding",** P.N.Rao, 3rd Ed.,Tata McGraw Hill, 2003.

ENGINEERING METROLOGY & MEASSUREMENTS

Sub Code :	**13AE36**	**Credits :**	**03**
Hours/Week :	**2+2+0**	**CIE Marks :**	**50**
Total Hours :	**36**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Introduction To Measurement System:

Definition, Requirements and Significance of measurement system, Methods of measurements, Generalized measurement systems, Definition and basic concepts of Accuracy, Precision, Calibration, threshold, sensitivity, hysteresis, repeatability, linearity, System response, delay, Errors in measuring instruments, Classifications of errors.

Transducers:

Definition, Classifications of transducers, Mechanical transducers, Electrical transducers, Piezoelectric transducers, Electronic transducers, Advantages and Disadvantages of each type of transducers. 06 h

UNIT II

Measurement Of Force, Torque And Pressure:

Introduction, Analytical Balance, Platform Balance, Proving Ring, Types of Dynamometers, Mechanical Dynamometers, Hydraulic Dynamometers, Fan Brake Dynamometers, Electric Dynamometers – Eddy Current and DC Dynamometers, Advantages of Hydraulic Dynamometers over Mechanical Dynamometers.

Introduction, Use of Elastic Members in Pressure Measurement, Mc Leod Gauge, The Bridgman Gauge, Thermal Conductivity Gages - Pirani Thermal Conductivity Gage, Thermocouple Vacuum Gauge. 08 h

UNIT III

Temperature Measurements And Strain Gage:

Introduction, Electrical Resistance thermometer, Thermoelectric Effects, Thermocouple, Laws of Thermocouples, Thermocouple materials and construction, Advantages and Disadvantages of Thermocouples, Optical Pyrometers and Radiation Pyrometers.

Introduction, Mechanical Strain Gages, Optical Strain Gages, and Electrical Resistance Strain Gages – Un-bonded type, Bonded Type and Piezo-resistive strain gages Preparation and Mounting of strain Gages, Gage Factor, Strain Measurement using wheat stone bridge, Calibration of Strain Gauges. 08 h

UNIT IV

Metrology Standards And Systems Of Limits, Fits And Tolerances:

Introduction, objectives of metrology, Standards of Length – International Proto type meter, Imperial Standard Yard, Wavelength standard, Subdivision of standards – Line Standard and End Standard, Calibration of End bars (Numerical) , Slip Gauges, Wringing Phenomena, Indian Standards (M-81, M-112), Numerical Problems on Building of Slip Gages.

Introduction, Need for Limit System, Definition of Limits, Concept of Limits of Size and Tolerance, Definition of Fit, Types of Fit and their designation, Special Types of Fit. Definition of Tolerance, Unilateral and Bilateral Tolerance, Concept of Interchangeability and Selective Assembly, Hole Basis System and Shaft Basis System, Brief Concept of design of Gauges (Taylor's Principles) Types of Gages and Gage Materials. 06 h

UNIT V

Comparators And Screw Thread Measurement:

Introduction, Characteristics, Classifications of Comparators, Mechanical Comparators – Johansson Microkator Comparators, Sigma Comparators, Dial Indicator, Optical Comparators – Zeiss Ultra Comparators, LVDT, Pneumatic Comparators, Back Pressure Comparators, Solex Gages. Screw Thread Terminology, Measurement of Major Diameter, Minor Diameter, Pitch, Angle and Effective Diameter of Screw threads by 2 wire method and 3 wire method, Best Size Wire, Autocollimator and Optical Flat. 08 h

Text Book

1. **"Mechanical measurements"** by Beckwith Marangoni and Lienhard,Pearson Education, 6th Ed., 2006.
2. **"Engineering Metrology"** by R.K.Jain, Khanna Publishers, 1994.

Reference Books

1. **"Engineering Metrology"** by I.C.Gupta, Dhanpat Rai Publications, Delhi.
2. **"Mechanical measurements"** by R.K.Jain.
3. **"Industrial Instrumentation"** Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002
4. **"Measurement Systems Applications and Design"** by Ernest O, Doblin, McGRAW Hill Book Co.

METROLOGY AND MEASUREMENTS LABORATORY

Sub Code :	**13AEL37**	**Credits :**	**1.5**
Hours/Week :	**0+0+3**	**CIE Marks :**	**50**
Total Hours :	**36**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Mechanical Measurements

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

UNIT II

Foundry Practice

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using

a) Lathe tool Dynamometer

b) Drill tool Dynamometer.

5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

MACHINE SHOP

Sub Code :	**11AEL38**	**Credits :**	**1.5**
Hours/Week :	**0+0+3**	**CIE Marks :**	**50**
Total Hours :	**36**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

UNIT II

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.

Scheme of Examination:

Student will be asked to conduct one experiment from each unit.

SEMESTER V

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code :	**13AEH51**	**Credits :**	**03**
Hours/Week :	**3+0+0**	**CIE Marks :**	**50**
Total Hours :	**36**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Management: Introduction Meaning· - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management &Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives - Types of plans (Meaning Only) - Decision making importance of planning - steps in planning & planning premises - Hierarchy of plans. 08 h

UNIT II

Organizing and Staffing: Nature and purpose of organization Principles of organization - Types of organization - DepartmentationCommittees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing - Process of Selection & Recruitment (in brief). 07 h

UNIT III

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co-Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief) 07 h

UNIT IV

Entrepreneur: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging' Class, Concept. of Entrepreneurship - Evolution of Entrepreneurship , Development of Entrepreneurship; Stage in entrepreneurship in India ; Entrepreneurship-its Barriers.

Small Scale Industries: Definition; Characteristics; Need and rationale; Objective; 'Scope; role of SSI in Economics Development. Advantage of SSI Steps to start and SSI-Government Policy towards SSI; Different Policies of Liberalization, Privatization , Globalization on SSI effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of Support ; Objectives ; Functions ; Types of Help; Ancillary Industry and Tiny Industry (Definition Only). 08 h

UNIT V

Institutional Support:
Different Schemes ; TECKSOK; KIADB; KSSIDC; KSIMC;DIC single Window Agency; SISI; NSIC;SIDBI;KSFC.

Preparation of Project:
Meaning of the project; Project Identification; Project Selection ; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commissions for project peport; Network Analysis; Error of project report ; Project Appraisal. Identification of Business Opportunities: Market Feasibility Study; Technical Feasibility Study & Social Feasibility Study. 06 h

Text Book

1. **Principles of Management**, P C Tripathi, P N Reddy, TMH, 2008
2. **Enterpreneurship and Management,** S Nagendra, V S Manjunath, Sanguine Technical Publishers, 2008.

Reference Book

1. **Entrepreneurship Development**, Poornima M Chavanthimath, Small Business Enterprises, Pearson Education, 2006

AIRCRAFT ELECTRICAL SYSTEM

Sub Code :	**13AE52**	**Credits :**	**03**
Hours/Week :	**2+2+0**	**CIE Marks :**	**50**
Total Hours :	**36**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNITI

Fundamentals of Electrical current: Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.
Electrical terminology & principles: Potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow. 07 h

UNIT II

DC sources on aircraft: Primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.
DC circuits: Ohms Law, Kirchhoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply. 07 h

UNIT III

AC generation on aircraft: Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Permanent Magnet Generators.
Power Distribution System: Bus Bar, split bus bar system, special purpose cables. Electrical diagram and identification scheme. Circuit controlling devices. 07 h

UNIT IV

AC Motors: Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and poly-phase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole. 07 h

UNIT V

Transformers : Transformer construction principles and operation; Transformer losses and methods for overcoming them; Transformer action under load and no-load conditions; Power transfer, efficiency, polarity markings; Primary and Secondary current, voltage, turns ratio.
Power Utilization Systems: Lighting system, Cockpit lights, anti-collision lights, taxi light, engine starting system, Fire detection system, Automatic fire extinguishing system. 08 h

Text Book

1. **Aircraft Electrical System** (3rd Edition) by- E H J Pallett, Pitman Publishers, 1987.

2. **Aircraft Electricity & Electronics** by- Thomas K. Eismin -Publishers: Glencoe & McGraw-Hill

Reference Books

1. **Aircraft Wiring and Electrical Bonding** - Advisory Circular (AC 21-99) Publisher Aircraft Technical Book Co 2005.

2. **Aircraft Wiring and Electrical Installation** – Publisher 'Avotek' 2005

AIRCRAFT STRUCTURES–I

Sub Code	**: 13AE53**	**Credits**	**: 04**
Hours/Week	**: 3+2+0**	**CIE Marks**	**: 50**
Total Hours	**: 48**	**SEE Marks**	**: 50**
Exam Hours	**: 03**		

Unit 1

Loads On Aircraft

Structural nomenclature – Types of loads – load factor – Aerodynamic loads – Symmetric manoeuvre loads– Velocity diagram – Function of structural components.

Materials for Aircraft Structures

Metallic and non-metallic materials, Use of Aluminium alloy, titanium, stainless steel and composite materials. Desirable properties for aircraft application

Mechanical Properties of Material

Stress–Strain-Tensile properties–Compression properties–Shear properties–Bearing properties– Creep and Stress properties–Fracture properties–Fatigue properties. **10h**

Unit 2

Statically Determinate and Indeterminate Structures

Analysis of plane truss–Method of joints–3DTruss-Plane frames, Composite beam-Clapeyron's Three Moment Equation-Moment Distribution Method**.** **09h**

Unit 3

EnergyMethods

Strain Energy due to axial, bending and Torsional loads-Castigliano's theorem- Maxwell's Reciprocal theorem, Unit load method – application to beams, trusses, frames, rings, etc.

Columns

Columns with various end conditions – Euler's Column curve – Rankine's formula -Column with initial curvature – Eccentric loading – Southwell plot–Beam column. **10h**

Unit 4

Theory of Elasticity

Concept of stress and strain**,** derivation of Equilibrium equations, strain- displacement relation, compatibility conditions and boundary conditions. Plane stress and Plane strain problems in 2D elasticity and Airy's Stress function. **09h**

Unit 5

FailureTheory

Maximum Stress theory–Maximum Strain Theory– Maximum Shear Stress Theory–Distortion Theory–Maximum Strain energy theory–Application to aircraft Structural problems. 10 h

TextBook

1. Mechanics of Materials, Dr. BC Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publication
2. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold,1995.
3. Timoshenko and Goodier, "Theory of Elasticity' McGraw Hill Co.

Reference

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.
2. Timoshenko, S., "Strength of Materials", Vol.I and II, Princeton D. Von Nostrand Co,1990.

AERODYNAMICS – I

Sub Code :	**13AE54**	**Credits :**	**04**
Hours/Week :	**3+2+0**	**CIE Marks :**	**50**
Total Hours :	**48**	**SEE Marks :**	**50**
Exam Hours :	**03**		

UNIT I

Review of Basic Fluid Mechanics

Continuity, momentum and energy equation, units and dimensions, inviscid and viscous flows, compressibility, Mach number regimes.

Description of Fluid Motion

Euler and Lagrangian descriptions, control volume approach to continuity and momentum equations, pathlines, streamlines and streaklines, angular velocity, vorticity, circulation, stream function, velocity potential and relationship between them. 10 h

UNIT II

Airfoil Characteristics

Fundamental aerodynamic variables, airfoil section geometry and wing plan form geometry, aerodynamic forces and moments, centre of pressure, pressure coefficient, calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds. 09 h

UNIT III

Two-Dimensional Inviscid Incompressible Flows Bernoulli's equation, pitot-tube measurement of airspeed, condition on velocity for incompressible flow, Euler's equations of motion, Governing equations for irrotational, incompressible flow, Laplace equation and boundary conditions. Two-dimensional source, sink and doublet flows, non-lifting flow over a two- dimensional circular cylinder and vortex flow. 10 h

UNIT IV

Flow Over Circular Cylinders Non-lifting flow over a two-dimensional circular cylinder, Lifting flow over a two-dimensional circular cylinder, Kutta-Joukowski theorem and generation of lift, D'Alembert's paradox.

Incompressible Flow Over Airfoils Kelvin's circulation theorem and the starting vortex, vortex sheet, Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils.

Introduction to Viscous Flows Navier-Stokes equations, boundary layer concept, displacement, momentum thickness and wall skin friction, viscous flow over two-dimensional streamlined and bluff bodies and drag characteristics, aspects of boundary layer separation and airfoil stall. 10 h

UNIT V

Introduction to Aerodynamic Testing Principles of wind tunnel flow simulation, open and closed circuit wind tunnels, and Major features of low speed, transonic and supersonic wind tunnels, smoke and tuft flow visualization techniques, Pressure and Aerodynamic load measurements on a model, total drag determination of two-dimensional bodies using wake survey at low speeds. 09 h

Text Book

1. Anderson, Jr J.D. "Fundamentals of Aerodynamics", Tata McGraw- Hill Publishing Co. Ltd., NewDelhi, 2007. (Special Indian Edition).
2. Houghton E.L and Carpenter P.W. "Aerodynamics for Engineering Students, CBS Publications and Distributors, 1993.(4th Edition).

Reference Book

1. Pope A. and Harper, JJ., "Low Speed Wind Tunnel testing", John Wiley Inc. New York, 1966
2. Anderson, Jr J.D. "Introduction to Flight", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007.(Special Indian Edition).
3. Schlichting, H. "Boundary Layer Theory" McGraw Hill, New York, 2004
4. Duncan WJ, Thomas and Young AD., "Mechanics of Fluids", Second Edition, Edward Arnold Printers Ltd, London,1981

AIRCRAFT PROPULSION

Sub Code : 13AE55 **Credits : 04**

Hours/Week : 3+2+0 **CIE Marks : 50**

Total Hours : 48 **SEE Marks : 50**

Exam Hours : 03

Unit1

Introduction Review of thermo dynamic principles, Principles of aircraft propulsion, Types of power plants, Basics of heat transfer; conduction, convection, radiation, diffusion mass transfer basic concepts and governing equations.

Fundamentals of Gas Turbine Engines Illustration of working of gas turbine engine– The thrust equation– Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics. **10h**

Unit 2

Subsonic and Supersonic Inlets for Jet Engines Internal flow and Stall in subsonic inlets –Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and external deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External decelaration – Models of inlet operation.

Combustion Chambers and Nozzles Classification of combustion chambers –Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders –.Theory of flow in isoentropic nozzles – Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under–expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces –Thrust reversal. 10 h

Unit 3

Compressors Principle of operation of centrifugal compressor – Work done and pressure rise –Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl – Rotation stall –Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional –Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics. **09 h**

Unit 4

Intoduction to Turbines: Types of turbines - Operating Principle - Design consideration – Velocity triangles– degree of reaction – performance parameters – Basics of blade design principles. **09h**

Unit 5

Ram jet Propulsion: Operating principle – Sub critical, critical and super critical operation – Combustion in ram jet engine – Ram jet performance – Sample ram jet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram-rocket

Fundamentals of Rocket Propulsion: Types and Classification of rockets. Operating principle – Specific impulse of a rocket – Rocket nozzle classification – Rocket performance considerations **10 h**

TextBooks

1. V. Ganesan, “GasTurbine”, Tata McGraw Hill Pub. Co. Ltd.,1996
2. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999.

References

1. Cohen, H.Rogers, G.F.C. and Saravanamuttoo, H.I.H .“Gas Turbine Theory”, Longman, 1989.
2. Oates, G.C., “Aerothermodynamics of Aircraft Engine Components”, AIAA Education Series, New York,1985.
3. “Rolls Royce Jet Engine”– ThirdEdition – 1983.
4. Mathur ,M.L. and Sharma, R.P., “GasTurbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 1999.
5. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., NewYork,5th Edn.,1993.
6. Heat & Mass Transfer by Domkundwar

ELECTIVES (GROUP A)
TURBO MACHINERY

Subject Code: 13AEE565 **Credits: 04**
Hours/Week: 4+0+0 **CIE Marks: 50**
TotalHours: 48 **SEE Marks: 50**
Exam Hours: 03

UNIT I

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies on Turbomachines. Efficiencies of turbomachines. Problems.

Thermodynamics of fluid flow: Static and Stagnation states-Incompressible fluids and perfect gases, Overall isoentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process. **10 h**

UNIT II

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems. 10 h

UNIT III

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems. **9 h**

UNIT IV

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging. Velocity triangles, design parameters. Problems. **09h**

UNIT V

Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Positive Displacement Pumps – Gear Pumps and Multi Piston Pumps. Problems. **10 h**

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.**)**

TEXT BOOKS:

1. Text Book of Turbomachines, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications,4th Ed,2008.
2. Turbomachine, B.K.Venkanna PHI, New Delhi 2009.

REFERENCE BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Principals of Turbomachines, D. G. Shepherd, The Macmillan Company (1964).
3. Fluid Mechanics & Thermodynamics of Turbomachines, S. L. Dixon, Elsevier (2005).
4. Fluid Mechanics and Hydraulic machines, Dr. Bansal, R.K .Lakshmi Publications, 2004.

AERODYNAMICS LABORATORY

Sub Code : 13AEL57		**Credits :**	**1.5**
Hours/Week : 0+0+3		**CIE Marks :**	**50**
Total Hours : 36		**SEE Marks :**	**50**
Exam Hours : 03			

LIST OF EXPERIMENTS

1. Calibration of a subsonic wind tunnel
2. Smoke flow visualization studies on a two-dimensional circular cylinder at low speeds.
3. Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at low speeds
4. Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.
5. Surface pressure distributions on a two-dimensional circular cylinder at low speeds and calculation of pressure drag.
6. Surface pressure distributions on a two-dimensional symmetric airfoil at zero incidence at low speeds.
7. Surface pressure distributions on a two-dimensional cambered airfoil at different angles of incidence and calculation of lift and pressure drag.
8. Calculation of total drag of a two-dimensional circular cylinder at low speeds using pitot-static probe wake survey.
9. Calculation of total drag of a two-dimensional cambered airfoil at low speeds at incidence using pitot-static probe wake survey.
10. Measurement of a typical boundary layer velocity profile on the tunnel wall (at low speeds) using a pitot probe and calculation of boundary layer displacement and thickness.

ENERGYCONVERSIONLABORATORY

Sub Code : 13AEL58		**Credits :**	**1.5**
Hours/Week : 0+0+3		**CIE Marks :**	**50**
Total Hours : 36		**SEE Marks :**	**50**
Exam Hours : 03			

PART–A (IndividualExperiments)

1. Determination of Flashpoint and Firepoint of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of lubricating oil using Redwood, Saybolt Viscometer and Torsion viscometers.
4. Valve Timing / port opening diagram of an I.C. engine (4stroke/2stroke).
5. Use of plani-meter. **18 h**

PART–B (GroupExperiments)

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP, heat balance sheet for,
   (a) Four stroke Diesel Engine
   (b) Four stroke Petrol Engine
   (c) Multi-cylinder Diesel/Petrol Engine,
   (Morse test)
   (d) Two stroke Petrol Engine

(e) Variable Compression Ratio I.C. Engine

18 h