SYLLABUS

FOR

B.TECH. PROGRAMME

IN

MECHANICAL ENGINEERING

INSTITUTE OF TECHNOLOGY

ZAKURA CAMPUS
UNIVERSITY OF KASHMIR
SRINAGAR J&K, 190006

COURSE STRUCTURE

B.Tech I[st] Semester in Mechanical Engineering

Zakura Campus, University of Kashmir

B.Tech. I. Year
Semester-I

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MTH-1117	Engineering Mathematics-I	3	1	0	4
CHM-1217	Engineering Chemistry	3	1	0	4
ELE-1317	Basic Electrical Engineering	3	1	0	4
CSE-1417	Fundamentals of Computer Programming	2	1	0	3
HUM-1517	Communication Skills	2	1	0	3
MEE-1617	Engineering Drawing	3	1	0	4
CHM-1217L	Engineering Chemistry Lab	0	0	2	1
ELE-1317L	Basic Electrical Engineering Lab	0	0	2	1
CSE-1417L	Fundamentals of Computer Programming Lab	0	0	2	1
	Total	16	6	6	25

COURSE STRUCTURE
B.Tech 2nd Semester in Mechanical Engineering
Zakura Campus, University of Kashmir

B.Tech. I. Year
Semester- II

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MTH-2117	Engineering Mathematics-II	3	1	0	4
PHY-2217	Engineering Physics	3	1	0	4
ECE-2317	Basic Electronics Engineering	3	1	0	4
MEE-2417	Computer Aided Drawing	2	1	2	4
MEE-2517	Fundamentals of Mechanics	3	1	0	4
PHY-2217L	Engineering Physics Lab	0	0	2	1
ECE-2317L	Electronics Engineering-Lab	0	0	2	1
MEE-2617W	Workshop Practice	2	0	2	3
	Total	16	5	8	25

COURSE STRUCTURE
B.Tech 3rd Semester in Mechanical Engineering
Zakura Campus, University of Kashmir

B.Tech. II. Year
Semester- III

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-3117	Mechanics of Materials-I	3	1	0	4
MEE-3217	Manufacturing Technology-I	2	1	0	3
MEE-3317	Theory of Machines	3	1	0	4
MEE-3417	Basic Engineering Thermodynamics- I	2	1	0	3
MTH-3517	Engineering Mathematics-III	3	1	0	4
MTH-3617	Electrical Engineering Technology	2	1	0	3
MEE-3117L	Mechanics of Materials-I Lab	0	0	2	1
MEE-3217L	Manufacturing Technology-I Lab	0	0	2	1
MEE-3317L	Theory of Machines Lab	0	0	2	1
MEE-3617L	Electrical Engineering Technology Lab	0	0	2	1
	Total	15	6	8	25

COURSE STRUCTURE
B.Tech 4th Semester in Mechanical Engineering
Zakura Campus, University of Kashmir

B.Tech. II. Year
Semester- IV

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-4117	Fluid Mechanics-I	3	1	0	4
MEE-4217	Applied Engineering Thermodynamics	3	1	0	4
MEE-4317	Engineering Mathematics-IV	3	1	0	4
MEE-4417	Materials Science	2	1	0	3
MEE-4517	Mechanics of Materials-II	3	1	0	4
MEE-4617	Industrial Engineering-I	2	1	0	3
MEE-4117L	Fluid Mechanics-I Lab	0	0	2	1
MEE-4217L	Applied Engineering Thermodynamics Lab	0	0	2	1
MEE-4617L	Industrial Engineering-I Lab	0	0	2	1
	Total	16	6	6	25

COURSE STRUCTURE

B.Tech 5th Semester in Mechanical Engineering

Zakura Campus, University of Kashmir

B.Tech. III. Year
Semester-V

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-5117	Machine Design-I	3	1	0	4
MEE-5217	Manufacturing Technology-II	3	0	0	3
MEE-5317	Industrial Engineering-II	3	0	0	3
MEE-5417	Engineering Mathematics-V	3	1	0	4
MEE-5517	Measurement and Instrumentation	3	1	0	4
MEE-5617	Introduction to Mechanical Vibrations	3	1	0	4
MEE-5217L	Manufacturing Technology-II Lab	0	0	2	1
MEE-5317L	Industrial Engineering-II Lab	0	0	2	1
MEE-5617L	Introduction to Mechanical Vibrations Lab	0	0	2	1
	Total	18	4	6	25

COURSE STRUCTURE
B.Tech 6th Semester in Mechanical Engineering
Zakura Campus, University of Kashmir

B.Tech. III. Year
Semester-VI

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-6117	Automatic Control	3	1	0	4
MEE-6217	Machine Design-II	3	1	0	4
MEE-6317	Heat Transfer	3	1	0	4
MEE-6417	Linear Optimization in Engineering	3	1	0	4
MEE-6517	Fluid Machinery	3	1	0	4
MEE-6617	Seminar	0	0	6	3
MEE-6317L	Heat Transfer - Lab	0	0	2	1
MEE-6517L	Fluid Machinery-Lab	0	0	2	1
	Total	15	5	10	25

COURSE STRUCTURE

B.Tech 7th Semester in Mechanical Engineering

Zakura Campus, University of Kashmir

B.Tech. IV. Year

Semester-VII

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-7117	Compressible Fluid Flow	3	1	0	4
MEE-7217	Internal Combustion Engines	3	1	0	4
MEE-7317	Numerical Techniques	3	1	0	4
MEE-7417	Introduction to Mechatronics	2	1	0	3
MEE-7517	Power Plant Engineering	2	1	0	3
MEE-7617	Pre Project	2	0	4	4
MEE-7717	Industrial Training*	0	0	2	1
MEE-7117L	Compressible Fluid Flow - Lab	0	0	2	1
MEE-7217L	Internal Combustion Engines - Lab	0	0	2	1
	Total	15	5	10	25

*The industrial training is to be covered in summer/winter break.

COURSE STRUCTURE
B.Tech 8th Semester in Mechanical Engineering
Zakura Campus, University of Kashmir

B.Tech. IV. Year
Semester-VIII

Course Code	Course Title	Teaching Classes Per Week			Credits
		L	T	P	
MEE-8117	Refrigeration and Air Conditioning	3	1	0	4
MEE-8217	Fundamentals of Tribology	3	1	0	4
MEC-80*	Departmental Elective	2	1	0	3
MEE-8517	Project	6	0	14	13
MEE-8117L	Refrigeration and Air Conditioning Lab	0	0	2	1
	Total	14	03	16	25

Departmental Electives	
Course No:	**Course Name**
MEC-80*	Theory of Elasticity
MEC-80*	Value Engineering
MEC-80*	Introduction to Acoustics
MEC-80*	Introduction to MEMS

Course Code: MTH-1117
Engineering Mathematics-I
Course Credits: 04

S. No:	Topics	No. of Hr
1.	Calculus: Differential calculus of functions of several variables, Partial differentiation, Homogeneous functions and Euler's theorem,	8
2.	Taylors and Maclaurin's series, Taylor's theorem and mean value theorem for functions of two variables, Errors and approximations	8
3.	Applications of Differential Calculus: Maxima and minima of several variables, Lagrange's method of multipliers for maxima and minima Curvature of Cartesian curves, Curvature of parametric & polar curves.	9
4.	Applications of Definite Integrals: Application of definite integrals to area, arc length, surface area and volume, Double integrals, Triple integrals.	8
5.	Vector Calculus: Scalar and vector fields, differentiation of vectors, Velocity and acceleration, Vector differential operator, Del, Gradient and Divergence, Physical interpretation of the above operators, Line, surface and volume integrals	9
6.	Application of Vector Calculus: Flux, solenoidal and irrotational vectors, Green's, Gauss' and Stokes' theorems and their applications.	8
Total number of Hours		50

S.No:	Books Recommended	Author	Publisher
1.	Advanced Engineering Mathematics	Kreyszig. E	John Wiley, Singapore.
2.	Advanced Engineering Mathematics	Jain, R. K and Iyengar. S. R.K	Narosa Publishing House.
3.	Differential Calculus	Das & Mukherjee	U.N. Dhur & Sons Pvt. Ltd.
4.	Integral Calculus	Das & Mukherjee	U.N. Dhur & Sons Pvt. Ltd.

Course Code: CHM-1217
Engineering Chemistry
Course Credits: 04

S. No:	Topic	No. of Hrs
1.	Electrochemistry: Reduction Potentials, Redox stability in water, The diagrammatic presentation of potential data, The effect of complex formation on potentials. Electrolytes and non-electrolyte solutions, Kinds of Electrodes, Concentration Cells, The Lead Storage Cell and Fuel Cell	7
2.	Laws of Photochemistry, Photo physical processes, Fluorescence and Phosphorescence, Photochemical reactions: photolysis of HI, Photochemical reaction between H2 and Br2, Rotational and Vibrational Spectroscopy-Principles and application to simple molecules, magnetic Resonance	7
3.	UV-visible spectrophotometry: Electronic transitions & electronic spectra, Application to simple systems (Analysis of Fe, Cu, Cr), Bear-lamberts' law & its applications. IR spectroscopy – IR spectrum, Application of IR Spectra (Alcohols, Acids, phenols, Concept of Vibrational Spectra.	7
4.	Environmental Chemistry:- Environmental segments, composition of atmosphere , earth's radiation balance, particles, Ions, & radicals in atmosphere, greenhouse effect, ozone layer in stratosphere –Its significance and consequence of depletion.	6
5.	Pollution: Air Pollution, Natural and man-made pollutants (CoX, NoX, HC, SoX, SpM, Acid rains). Effect of pollutants on human and plant life. Sources and classification of water pollutants (Organic, Inorganic, Sediments, Radioactive materials, heat.)	6
6.	Water and its treatment: Alkalinity of water, Determination of Alkalinity by using phenolphthalein and methyl orange indicators. Hardness of water, its types, methods of estimation. Treatment of water (Municipal treatment, lime soda process, demineralization by ion exchange process.	5
7.	Lubricants: Introduction, surface roughness, concept of friction and wear, lubrication, Mechanism of hydrodynamics, boundary and extreme pressure lubrication. Classification of lubricants, semi-solid & liquid lubricants, blended oils, synthetic lubricants, Lubricating emulsions. Properties of greases, liquid lubricants with special reference to flash point, viscosity and viscosity index. Criteria for selection of lubricants for specific purposes.	6
8.	Inorganic Systems: Transition Metals, fundamental concepts of transition metal complexes, consequences of orbital splitting, color and magnetic properties. Structure and bonding of organo-metallic complexes, the sixteen and eighteen electron rule. Role of trace metals in biological systems, oxygen carrier and electron transfer.	6
	Total number of Hours	50

S. No:	Books Recommended	Author	Publisher
1.	Inorganic Chemistry	Shriver. D. FandAtkin. A. W	OxfordPress,Delhi.
2.	Physical Chemistry	Castellan. G.W	Narosa Publications.
3.	Principles ofInstrumentalAnalysis	Skoog. D. AandHolles. F.J	HercaurtAsiaPTELtd.
4.	Chemistry for changing times	Hill. J. W	Macmillan, Canada.
5.	Engineering Chemistry	Jain.P.C	DhanpatRai&Sons.

Course Code: ELE-1317
Basic Electrical Engineering
Course Credits: 04

S. No:	Topics	No. of Hrs
1.	Review of basic electrical Signals, Review of electric circuit concepts, Terminology, Electric circuit parameters (Resistance, Conductance, Inductance, Capacitance, Reactance, Impedance), Basic electric circuit terminologies: Nodes, Junctions, Paths, Loops, Branches, Series and Parallel combinations of resistance.	3
2.	Ideal and practical voltage and current sources and their transformation, Dependent Sources, Power and energy relations, Ohm's law: validity of ohms law, Ohmic and non Ohmic conductors, applications of ohms law.	5
3.	Introduction to D.C. voltage & Current and D.C. circuits, Voltage and current Divider Laws, Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL), Analysis of series & parallel D.C. Circuits: Loop analysis of D.C. Circuits, Nodal methods of analysis, Mesh analysis, Super node, and Super mesh.	8
4.	Super-position theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Reciprocity & Millman's theorem, Delta-Star (Y) Transformations.	7
5.	Introduction to Alternating Voltage & Current and A.C. circuits, Basic terminology and definitions (Signal, Parameters, Generation, Applications, non-sinusoidal A.C.'s, EMF Equations, Mean, Average, RMS, Peak, and Form Factor), Complex number representation of A.C. circuits.	7
6.	Phasor representation of A.C. circuits, Solutions of sinusoidally excited RLC circuits, Power and energy relations in A.C. circuits, Concepts of active & reactive powers.	7
7.	Applications of network theorems to A.C. circuits, Resonance in series and parallel circuits.	6
8.	Single and three phase A.C. systems, Analysis of 3 phase systems, Current and voltage relationships in Y-Δ&Δ-Y configurations, Balanced / un-balanced systems.	7
	Total number of Hours	50

S. No:	Books Recommended	Author	Publisher
1.	Fundamentals of Electric Circuits	Alexander & Sadiku	McGraw-Hill.
2.	Engineering circuit Analysis	Hayt & Kimberly	McGraw-Hill.
3.	Electric Engineering Fundamentals	Vincent Del Toro	PHI.
4.	Introduction to Circuit Analysis & Design	Glisson	Springer.
5.	Basic Electric Circuit Analysis	Johnson, Hilburn, Johnson	Wiley.

Course Code: CSE-1417
Fundamentals of Computer Programming
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Introduction to Programming and Problem Solving – Types of Programming Languages- Machine Level, Assembly level, and High Level language.	2
2.	Introduction to C Language – Brush-up of algorithms and flowcharts. Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement.	5
3.	Simple C programs Conditional Statements and Loops -Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement.	5
4.	Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming.	4
5.	Arrays - one dimensional array: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices.	6
6.	Functions- Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.	6
7.	Structures and Unions - Structure , nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions,	5
8.	Pointers- Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays.	6
	Total number of Hours	39

S. No:	Books Recommended	Author	Publisher
1.	Programming with C	Byron Gottfried	Pearson Education.
2.	Programming with ANSI & Turbo C	A. Kamthane	Pearson Education.
3.	Programming in C	Pradip Dey, Manas Ghosh	Oxford University Press.
4.	Programming Language Concepts and Constructs	Ravi Sethi	Pearson Education.

Course Code: HUM-1517
Communication Skills
Course Credits: 03

S. No:	Topic	No. of Hrs
1.	Communication: Meaning, its types, significance, process, Channels, barriers to Communication, making communication effective, role in society, Communication model.	5
2.	Discussion Meeting and Telephonic Skills: Group discussions, conducting a meeting, attending telephonic calls, oral presentation and role of audio visual aids.	5
3.	Grammar: Transformation of sentences, words used as different parts of speech one word substation, abbreviations, technical terms etc.	5
4.	Reading Skills: Process of reading, reading purposes, models, strategies, methodologies, reading activities.	4
5.	Writing Skills: Elements of effective writing, writing style, scientific and technical writing.	4
6.	Listening Skills: The process of listening, the barrier to listening, the effective listening skills, feedback skills. Speaking Skills: Speech mechanism, organs of speech, production and classification of speech sound, phonetic transcription, the skills of effective speaking, the components of effective talk.	5
7.	Business Letters: Structure of business letters, language in business letters. Letters of inquiry & their places. Sales Letters, Memorandum, Quotations/tenders, Bank correspondence, Letters of application and appointments,	4
8.	Resume writing, Report Writing,	3
9.	Conducting a Meeting, Minutes of Meeting, Oral Presentation, Group Discussion, CV writing, Purchase order, Job Application Letter.	4
	Total number of Hours	39

S. No	Books Recommended	Author	Publisher
1.	Effective Business Communication	Rodriques M V	Concept Publishing Company.
2.	Handbook of Practical Communication Skills	Wright, Chrissie	Jaico Publishing.
3.	An Approach to Communication Skills	Bhattacharya. Indrajit	Dhanpat Rai Co.
4.	Modern Business Correspondence	Gartside L	Pitman Publishing. London
5.	How to Write and Publish a Scientific Paper	Day, Robert A	Cambridge University.
6.	An Introduction to the Pronunciation of English	Gimson A C	ELBS.

Course Credits: MEE-1617
Engineering Drawing
Course Credits: 04

S. No:	Topics	No. of Hrs
1.	Introduction to engineering drawing (equipment, drafting tools, symbols and conventions in drawing), dimensioning, types of lines and their use, dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and hexagon. Conic sections, ellipse, parabola, hyperbola, cycloid and trochoid.	04
2.	Projection of lines: Line parallel to both the planes, Line parallel to the horizontal plane and perpendicular to the vertical plane, line parallel to HP and inclined to VP, line parallel to HP and inclined to profile plane, line parallel to VP and inclined to HP, line inclined to both the planes.	09
3.	Projection on horizontal and vertical planes, principal views, different system of projections, symbols, notations. Projection of Planes in first and third quadrant. Projection of solids in first and third quadrant, axis parallel to one and perpendicular to other.	09
4.	Section planes perpendicular to one plane and parallel or inclined to other plane.	09
5.	Development of prisms, pyramids and cylindrical & conical surfaces.	09
6.	Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection.	10
	Total number of Hours	50

S. No:	Books Recommended	Author	Publisher
1.	Engineering Graphics and drafting	Gill.P.S	Katria and Sons, Delhi.
2.	Elementary Engineering Drawing-Plane and Solid Geometry	Bhat.N.D.	Chartotar Publishing House, Anand.
3.	Fundamentals of Engineering Drawing	Luzzad.W.J.	Prentice Hall of India Private Limited, New Delhi.

Course Credits: CHM-1217L
Engineering Chemistry LAB
Course Credits: 01

S. No:	Experiment
1.	To draw the pH-titration curve of strong acid vs. strong base.
2.	Standardization of $KMnO_4$ using sodium oxalate.
3.	Determination of Ferrous iron in Mohr's salt by potassium permanganate.
4.	Determination of partition coefficients of iodine between benzene and water.
5.	Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
6.	Determination of total hardness of water by EDTA method.
7.	To verify Bear's law for a colored solution and to determine the concentration of a given unknown solution.
8.	Synthesis of some polymers like Crazy ball.

Course Credits: ELE-1317L
Basic Electrical Engineering LAB
Course Credits: 01

S. No:	Experiment
1.	To study the colour coding of resistors
2.	Connection of Ammeters, Voltmeters, Wattmeter's and multi-meters in DC and AC circuits and selection of their ranges.
3.	Use of LCRQ meter.
4.	To study the series / parallel operation of resistors and verifying their effective values by LCRQ meter.
5.	To verify the KVL and KCL in DC circuits.
6.	To verify the star delta transformation of networks.
7.	To verify the superposition theorem.
8.	To verify the maximum power transfer theorem
9.	Basic R, L, C circuits excited from A.C
10.	To measure electric power in single-phase AC circuits with resistive load, RL load and RLC load.
11.	To measure the power and power factor in three phase AC circuits.
12.	To study the series resonance.
13.	To study the parallel resonance.
14.	To study the handling of CRO and use it for the study of different voltage waveforms.

Course Code: CSE-1417L
Fundamentals of Computer Programming LAB
Course Credits: 01

S. No:	Experiment
1.	Program to understand basic data types.
2.	Programming on looping and decision statements.
3.	Example of Fibonacci series program.
4.	Finding a factorial for a given number.
5.	Programs using i. Library functions. ii. Built-in math functions.
6.	Programs on i. functions ii. arrays iii. string manipulations iv. Structures and unions. v. Pointers. vi. Basic file operations.

Course Code: MTH-2117
Engineering Mathematics- II
Course Credits: 04

S. No:	Topic	No. of Hours
1.	Matrices: Rank of a matrix, Elementary transformations, Consistency and solutions of a system of linear equations by matrix methods, Eigen values & Eigen vectors, Properties, Cayley-Hamilton's theorem	9
2.	Ordinary and Linear Differential Equations: Formation of ordinary differential equations, Solution of first order differential equations by separation of variables	7
3.	Homogeneous equations, Exact differential equations, Equations reducible to exact form by integrating factors, Linear differential equations with constant coefficients, Cauchy's homogeneous linear equations, Legendre's linear equations	8
4.	Partial Differential Equations: Formulation and classification of PDE's, Solution of first order linear equations, Four standard forms of non-linear equations, Separation of variable method for solution of heat, wave and Laplace equation	9
5.	Probability: Basic concepts of probability, Types of probability: Marginal, joint and conditional, probability rules: Addition, Multiplication, complement; Probability tree, probability under conditions of statistical independence and dependence, Bayes' Theorem.	9
6.	Random Variables and Distribution: Random variables, Probability distribution, Probability density function, Discrete and continuous distributions- Binomial, Poisson, Normal distributions, Measures of central tendency and dispersion, Sampling distribution, standard error, Central limit theorem	8
	Total number of Hours	50

S. No:	Books Recommended	Author	Publisher
1.	Advanced Engineering Mathematics	Kreyszig.E	John Wiley
2.	Advanced Engineering Mathematics	Jain.R.K & Iyengar.S.R.K	Narosa Publishing House
3.	Matrices	Frank Ayres	McGraw Hills
4.	Advanced Mathematical Analysis	Malik &Arrora	S. Chand &Co

Course Code: PHY-2217
Engineering Physics
Course Credits: 04

S. No:	Topics	No. of Hrs
1.	Vectors and Electrostatics: Work and energy in electrostatics; dielectrics, Polarization, electric displacement, Susceptibility & permittivity, Clausius Mossotti equation. Transformation of vectors. Spherical and cylindrical coordinates system, Gradient of a scalar.	7
2.	Divergence and curl of a vector, Gauss's law and its applications, Electric potential and electric field (in vector form), Potential due to a monopole, Dipole and multipoles (multipole expansion).	7
3.	Magneto-statics: Lorentz Force Law; magnetic field of a steady current (Biot-Savart law), Ampere's law and its applications, Ampere's law in magnetized materials.	6
4.	Electrodynamics Electromotive force, Faraday's law, Maxwell's Equations, Wave Equation. Poynting Vector, Poynting Theorem (Statement only), Propagation of EM-Wave in conducting and non-conducting media. Interference due to division of wave front and division of amplitude. Young's double slit experiment.	7
5.	Interference and Diffraction: Interference and principle of superposition. Theory of biprism, Interferences from parallel thin film, wedge shaped films, Newton's rings, Michelson Interferometer. Fresnel's Diffraction, Diffraction at straight edges, Fraunhoffer diffraction due to N-Slits, Diffraction grating, dispersive power of grating, resolving power of prism and grating.	6
6.	Theory of Relativity: Invariance of an equation and concept of ether, Michelson Morley experiment, Einstein's postulates and Lorentz transformation equations, length, time and simultaneity in relativity, addition of velocity, variation of mass with velocity, mass-energy relation, energy- momentum relation.	6
7.	Quantum Theory: The Compton effect, matter waves; group and phase velocities, Uncertainty principle and its application; time independent and time dependent.	5
8.	Schrodinger wave equation, Eigen values and Eigen functions, Born's interpretation and normalization of wave function, orthogonal wave functions, applications of Schrodinger wave equation (particle in a box and harmonic oscillator).	6
	Total number of Hours	50

S. No	Books Recommended	Author	Publisher
1.	Introduction toElectrodynamics	Griffiths. D	PrenticeHallofIndia
2.	Perspective ofModernPhysics	Beiser	McGraw-Hill
3.	ElementaryModern Physics	Arya.A.P	Addison-Wesley, Singapore
4.	Introduction toModernPhysics	Mani.H. S.andMehta.G.K	Affiliated East West Press, New Delhi

Course Code: ECE-2317
Basic Electronics Engineering
Course Credits: 04

S. No:	Topic	No. of Hrs
1.	Solid State Physics: Energy bands and charge carriers in semiconductors: energy bands - metals- semiconductors and insulators direct and indirect semiconductors- charge carriers in semiconductors: electrons and holes-intrinsic and extrinsic material: n-material and p-material-carrier concentration.	6
2.	Fermi level- EHPs- temperature dependence- conductivity and mobility- drift and resistance- effect of temperature and doping on mobility, Hall Effect. Diffusion of carriers – derivation of diffusion constant D-Einstein relation-continuity equation.	6
3.	P-N junctions: contact potential-equilibrium Fermi levels- space charge at junctions- current components at a junction: majority and minority carrier currents.	6
4.	Diodes: volt-ampere characteristics-capacitance of p-n junctions. Diode as circuit element. Half wave – full wave, Rectifiers: Centre Tapped and bridge rectifiers-working-analysis and design-C filter analysis.	5
5.	Zener and avalanche breakdown-Zener diodes: volt-ampere characteristics-regulated power supplies - IC based regulated power supplies.	6
6.	Tunnel diodes: tunneling phenomena -volt-ampere characteristics- Varactor diodes- Photo diodes: detection principle- light emitting diodes- volt-ampere characteristics.	6
7.	Transistors: Bi polar junction transistors NPN and PNP transistor action-open circuited transistor- biasing in active region-majority and minority carrier distribution- terminal currents- operation- characteristics.	7
8.	Types of Transistor Configurations:-CE, CB and CC configurations. Transistor as Amplifier. Field effect transistors: operation-pinch off and saturation-pinch off voltage-gate control- volt-ampere characteristics.	4
9.	MOSFETS n-channel& p-channel. Depletion and enhancement modes.	4
	Total number of Hours	50

S.No:	Books Recommended	Author	Publisher
1.	Solid State Electronic Devices	Streetman.B.G	Prentice Hall of India
2.	Electronic devices and circuits	Boylsted.R and L. Nashelsky	Prentice Hall Publications
3.	Electronic devices	Floyd	Pearson Education
4.	Electronic Principles	Malvino	Tata McGraw Hill

Course Code: MEE-2417
Computer Aided Drawing
Course Credits: 04

S. No:	Topics	No. of Hrs
1.	Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.	05
2.	Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), Flanged nut, slotted nut.	06
3.	Locking arrangement for nuts: taper and split pin for locking Simple assembly using stud bolts with nut and lock nut, countersunk head screw, grub screw, Allen screw.	04
4.	Eye foundation bolt, Rag foundation bolt, Lewis foundation bolt and Cotter foundation bolt.	02
5.	Riveted joints: Forms and proportions of rivet heads, Different views of different types of riveted Lap and Butt joints.	04
6.	Shaft joints: Cotter joint and Knuckle joint, Socket and Spigot joint.	04
7.	Shaft coupling: Muff, Flanged, Flexible, Universal and Oldham's coupling.	04
8.	Shaft bearing: Solid and bush bearing, Plummer block, Footstep bearing.	06
9.	Spur gear in mesh with approximate construction of tooth profile, Rack and pinion.	05
10.	Assembly and detailed drawings of Engine Parts: Piston, Stuffing box, cross head, Vertical & Horizontal engine, Connecting rod, Crank, Eccentric. Valves: Steam stop valves, Feed check valve, Safety valves, Blow off cock.	10
	Total number of Hours	50

S.No:	Books Recommended	Author	Publisher
1.	Machine Drawing	Bhat. N. D	Charotar Publishing house private limited.
2.	Machine Drawing	Gill.P.S.	Katria and Sons, Delhi

Course Code: MEE-2517
Fundamental of Mechanics
Course Credits: 04

S. No:	Topics	No. of Hrs
1.	Equilibrium of a particle, Condition for the Equilibrium of a Particle, The Free-Body Diagram, Coplanar Force Systems, Three-Dimensional Force Systems	02
2.	Force System Resultants Moment of a Force—Scalar Formulation, Cross Product, Moment of a Force—Vector Formulation, Principle of Moments, Moment of a Force about a Specified Axis, Moment of a Couple, Simplification of a Force and Couple System, Further Simplification of a Force and Couple System, Reduction of a Simple Distributed Loading.	06
3.	Moments of Inertia Definition of Moments of Inertia for Areas, Parallel-Axis Theorem for an Area, Radius of Gyration of an Area, Moments of Inertia for Composite Areas, Product of Inertia for an Area, Moments of Inertia for an Area about Inclined Axes.	05
4.	Planar Kinematics of a Rigid Body, Translation: Rotation about a Fixed Axis, Absolute Motion Analysis, Relative-Motion Analysis (velocity), Instantaneous Centre of Zero Velocity, Relative-Motion Analysis (acceleration),Relative-Motion Analysis using Rotating Axes.	05
5.	Planar Kinetics of a Rigid Body, Force and Acceleration: Mass Moment of Inertia, Planar Kinetic Equations of Motion (translation, rotation about a fixed Axis, General Plane Motion).	07
6.	Planar Kinetics of a Rigid Body, Work and Energy: Kinetic Energy, The Work of a Force, The Work of a Couple Moment, Principle of Work and Energy, Conservation of Energy.	07
7.	Planar Kinetics of a Rigid Body, Impulse and Momentum: Linear and Angular Momentum, Principle of Impulse and Momentum, Conservation of Momentum, Eccentric Impact.	06
8.	Three-Dimensional Kinematics of a Rigid Body: Rotation About a Fixed Point, The Time Derivative of a Vector Measured from Either a Fixed or Translating-Rotating System, General Motion, Relative Motion Analysis Using Translating and Rotating Axes.	06
9.	Three-Dimensional Kinetics of a Rigid Body: Moments and Products of Inertia, Angular Momentum, Kinetic Energy, Equations of Motion, Gyroscopic Motion, Torque-Free Motion.	06
	Total number of Hours	50

S.No:	Books Recommended	Author	Publisher
1.	Statics and Dynamics	Hibbeler. R.C	Prentice Hall, N. Jersey, USA.
2.	Engineering Mechanics, Vol.1 and Vol. 2	Meriam, J.L. and Kraige, L.G.	John Wiley & Sons Inc

Course Code: PHY-2217L
Engineering Physics LAB
Course Credits: 01

S. No:	Experiment
1.	Measurement of Resistance.
2.	Measurement of e/m by Helical method.
3.	Measurement of Numerical Aperture of Optical Fiber.
4.	Determination of Resistivity of a given wire.
5.	Determination of Band Gap of a semiconductor.
6.	Verify Biot-Savart law.
7.	To determine the refractive index of the prism material using spectrometer.
8.	To verify the laws of vibrating strings by Melde's experiments.
9.	To determine the wavelength using Fresnel's biprism/diffraction grating.
10.	To Determine Plank'sConstant.

Course Code: ECE-2317L
Basic Electronics Engineering LAB
Course Credits: 01

S. No:	Experiment
1.	Characterize various commercial diodes on the basis of voltage and current ratings. Study/simulation of their I-V characteristics using multi-sim/p-spice.
2.	Characterize various commercial Zener diodes on the basis of voltage and current ratings, Study/simulation of I-V characteristics of Zener Diode.
3.	Study of I-V characteristics of a Light emitting Diode. Design of current limiting resistors for different input voltages.
4.	To assemble/simulate a half wave rectifier using power diodes and LEDs and study their performance.
5.	To assemble/simulate a centre tapped full wave rectifier using power diodes and LEDs and study their performance.
6.	To assemble/simulate a bridge wave rectifier using power diodes and LEDs and study their performance
7.	Study/simulation of diode applications like clippers, clampers, protection circuits.
8.	Study of Zener diodes as voltage regulators.
9.	Design of an IC based Voltage regulator.
10.	Study V-I characteristics of transistor (PNP and NPN). Calculate the performance parameters of transistor.
11.	Use NPN transistor as an inverter switch.

Course Code: MEE-2617W
Workshop Practice
Course Credits: 03

S. No:	Topic	No. of Hrs
1.	**Machining section** (a) Theoretical instructions: Safety precautions, working principal of milling, shaper, slotter, grinding, power hacksaw and other related metal-cutting machine, basic operations of various machines, introduction of various types of cutting tools (Nomenclature). (b)Practical demonstrations: Demonstration of knurling thread cutting, boring etc. on lathe machine, simple operations on milling, shaper, slotter/planner and grinding machines, simple jobs involved all the basic operations on shaper, milling and grinding machines. Aim: To prepare a cylindrical job on lathe for manufacturing of a gear on milling machine.	06
2.	**Sheet Metal and Spray Painting section** (a) Theoretical instructions: Safety precautions, soldering, brazing and shearing, fluxes in use and their applications, study of material used for painting, knowledge of different machines such as shearing, bending, wiring and power presses, method of pattern development in detail, study of air compressor and air guns: its use, care, maintenance and operating instructions, advantages of spray painting, knowledge of different sheet metal materials. (b) Practical demonstrations: Exercise in rating, soldering and brazing of making jobs of various materials such as trays, flower vases, photo frame etc., and preparation of surfaces for painting by using a spray gun with the help of air compressor. Aim: To develop a funnel as per the drawing with soldering.	06
3.	**Fitting and Bench work section** (a) Theoretical instructions: Safety precautions, introduction of common materials using in fitting shop, description and demonstration of various work holding devices such as surface plate and V-block, introduction and use of measuring tools like vernier caliper, micro-meter, height gauge, profile projector, surface roughness tester and other gauges. (b) Practical demonstrations: Demonstration of angular cutting, practice of 450, preparation of stud to cut external threads with the help of dies, drilling, countersinking, counter boring and internal thread cutting with taps, pipe cutting practice and thread cutting on G.I pipe with pipe dies. Demonstration of tap sets and measuring equipment's. Aim: To assemble the mild steel work pieces with radius fitting.	04
4.	**Welding Section** (a) Theoretical instructions:Safety precautions, introduction of all welding processes like gas welding, MIG welding, TIG welding, submerged arc welding and spot welding, advantages and disadvantages over electric arc welding and their applications, welding techniques like right ward, left ward and over head, various fluxes and electrode used in welding, difference between A.C. and D.C. welding, characteristics, size and class of electrodes.(b) Practical demonstrations: Demonstration of different types of joints by using gas welding and arc welding etc. Aim: To make V-butt joint, out-side corner joint and head tee-joint	06
5.	**Foundry and Casting section** (a) Theoretical instructions: Safety precautions, introduction to casting processes, basic steps in casting processes, types of pattern, allowances, risers, runners, gates, moldings and its composition and preparation, moulding methods, core sand and core making, mould assembly, casting defects and remedies, introduction of Cupola, various test of moulding sand like, shatter index	06

	test, moisture content test, grain fineness test etc. (b) Practical demonstrations: Demonstration and practice of mould making with the use of split patterns and cores, sand preparation and testing, casting practice of various materials like brass, aluminum, waxes etc. by using different types of patterns. Aim: To prepare a greens and moulds by using split and self cored pattern for casting.	
6.	**Smithy and Forging section** (a) Theoretical instructions: Safety precautions, introduction of various forging methods like hand forging, drop forging, press forging and machine forging and defects, brief description of metal forming processes, comparison of hot and cold working, introduction of forging machines, such as forging hammer and presses. (b)Practical demonstrations: Demonstration and practice of MS rod into forged MS ring and octagonal cross-section. Aim: To prepare a square headed bolt from MS-round.	06
7.	**Carpentry and pattern making Section** (a)Theoretical instructions: Safety precautions, introduction of wood, different methods of seasoning, quality of good timber, wood working machines like band saw, circular saw, jig saw, lathe, grinder, thickness planning machine, mortise machine and radial saw. (b) Practical demonstrations: Demonstration and practice of different types of joints, technical terms related to joinery their description, identification and application, polishing, putting and material use, their names, ingredients, methods of preparation and use, joining materials like nuts, screws, dovels, hinges, glue, window and roof trusses. Aim: To prepare scarf joint and pen stand as per the drawing.	05
	Total number of Hours	39

S.No:	Books Recommended	Author
1.	Workshop Technology Vol. I	Chapman
2.	Workshop Technology Vol. II	Hajra Chowdhary
3.	Workshop Technology Vol. I	Swarn Singh
4.	Workshop Technology Vol. I	Virender Narula

Course Code: MEE-3117
Mechanics of Materials-I
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Introduction to Cartesian tensors, range and summation conventions, free and dummy indices, coordinate transformations and definition of second order Cartesian tensor. Stress components, stress tensor, displacement field, strain components, strain in terms of displacement field, strain tensor.	04
2.	Introduction to mechanical properties of solids, proof stress, poisons effect, strain hardening, stress strain diagrams of ductile and brittle materials, idealized one dimensional stress strain laws, allowable stresses, factor of safety.	06
3.	Axially loaded members, Saint-Venant's Principle, Elastic Deformation, Principle of Superposition, Bars with Continuously Varying Loads or Dimensions, Statically Indeterminate Members, The Force Method of Analysis, Thermal Stress and Stress Concentrations.	08
4.	Plane Stress: Principal and Maximum Shear Stresses, Mohr's Circle, Hooke's Law, Triaxial Stress. Plane Strain: general equations of transformation, Mohr's circle, Absolute maximum shear strain, Tri axial stresses, strain energy density and Strain rosettes. Complex Stresses, Stresses on oblique planes, Material subjected to pure shear, mutually perpendicular direct stress, combined direct and shear stresses, Principal plane inclination in terms of the associated principal stress.	10
5.	Strain energy – tension, compression, shear, bending, torsion, three-dimensional principal stress system, Volumetric or dilatational, shear or distortional strain energy, Suddenly applied loads, Impact loads, axial load and bending applications. Torsion, Deformations of a Circular Bar of Linearly Elastic Materials, Non uniform Torsion, Stresses and Strains in Pure Shear, Relationship Between Moduli of Elasticity E and G, Transmission of Power by Circular Shafts, Statically Indeterminate Torsional Members, Strain Energy in Torsion and Pure Shear, Torsion of Noncircular Prismatic Shafts, Thin-Walled Tubes, Stress Concentrations in Torsion.	10
6.	Types of Beams, Loads, and Reactions, Shear Forces and Bending Moments, Relationships Between Loads, Shear Forces, and Bending Moments, Shear-Force and Bending-Moment Diagrams. Stresses in Beams, Pure Bending and symmetric Bending, Curvature of a Beam, flexure formula and its applications, Shear Stresses in Beams of Rectangular Cross Section, Shear Stresses in Beams of Circular Cross Section and in the Webs of Beams with Flanges, Built-Up Beams and Shear Flow, Beams with Axial Loads, Stress Concentrations in Bending.	12
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Mechanics of Materials	Beer and Johnston	McGraw Hill, 2015

S.No:	References Recommended	Author	Publisher
1.	Mechanics of Materials	J.M. Gere and S.P. Timoshenko	Cengage Learning,1997
2.	Introduction to Solid Mechanics	I.H. Shames and J.M. Pitarresi	Prentice Hall of India,1999
3.	Engineering Mechanics of Solids	Popov. E.P	Prentice Hall of India, 2004

Course Code: MEE-3217
Manufacturing Technology – I
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Casting: Pattern types, allowances and design considerations, moulding materials, core sands, sand testing of moulding sands, types of cores, mounding machines, centrifugal, die, investment, shell, and CO_2 casting methods, Casting defects and inspection of castings, automation in foundry.	13
2.	Classification of machining processes and machine tools, orthogonal cutting, cutting forces, Ernest Merchant metal cutting theory, basic geometry of single point tools, construction, working and machining operations on center lathe, Capstan and Turret lathe, drilling machines, shapers (mechanical and hydraulic type), planner, boring and broaching machines, surface broaching, slotters, milling machines, milling operations.	13
3.	Manufacture of grinding wheels, Selection of grinding wheel, working of surface and center less grinding machines, center less grinding (internal and external) dressing, turning, balancing and mounting of wheel defects and remedies in grinding. Metal finishing process: purpose of finishing surface, honing, lapping, polishing and buffing.	13
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Materials and Processes in Manufacturing	Degarmo. E.P, Black. J.T. and Kohser. R.A	Prentice Hall of India, 2005

S.No:	References Recommended	Author	Publisher
1.	Manufacturing Processes for Engineering Materials	Serop. K and Steven. R.S.	Prentice Hall of India, 1998

Course Code: MEE-3317
Theory of Machines
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Introduction, Kinematics and dynamics, kinematic chain, Mechanisms and Degree of freedom (DOF), Lower pairs & higher pairs, Kutzbach criterion and Grubler's eqn., Grashof's law, inversions, and quick return mechanism, mechanical advantage, , Instantaneous centre, velocity and acceleration analysis.	09
2.	Friction of nut and screw, Screw jack, Torque required to lift and lower loads, efficiency, Pivot and collars & journal bearings, Friction clutches, Single and multidisc plate clutch, Brakes, classification, Braking of vehicle.	09
3.	Analysis of different types of governors (watt, porter, Hartnel and Proel), sensitivity, stability, hunting, Isochronism, effort and power of a governor. Analysis and importance of flywheel.	08
4.	Classification of cams and followers, Terminology for cams, types of motion curves and their analytical expressions, graphical construction of cam profile for different types of followers, pressure angle , force analysis of cam-follower systems.	08
5.	Rolling contact and positive drive, classification of gears, Nomenclature, Law of gearing, Conjugate teeth, involute and cycloidal profile system of gear teeth, Length of path of contact, arc of contact, contact ratio, Gear ratio, Interference and undercutting, Helical and spiral gears. Gear trains: Classification, Types, simple gear train, speed ratios, Compound, reverted, Epicyclic gear train, tabulation and algebraic method, Compound epicyclic train.	08
6.	Processional motion and angular acceleration, gyroscopic couple, reaction couple. Effects on an aeroplane, naval ship, Stability analysis of a two-wheel vehicle, Stability of a four-wheel drive on a curved path.	08
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Theory of Mechanisms and Machines	Amitabha Ghosh and Ashok Kumar Mallik	EWP, 2007

S.No:	References Recommended	Author	Publisher
1.	Theory of Machines	Shigley	McGraw Hill, 1995
2.	Theory of Machines	Bevan	C.B.S Publication, 1997

Course Code: MEE-3417
Basic Engineering Thermodynamics-I
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Fundamental concepts and definitions: Introduction, microscopic and macroscopic views of matter, control volume, thermodynamic systems, properties, processes, cycles, thermal equilibrium, Zeroth law of thermodynamics, temperature, thermodynamic equilibrium, temperature scale, energy and the first law, mechanical concept of energy, internal energy, conservation of energy, energy transfer as work, various modes, energy transfer as heat, First law for closed system, limitations of first law of thermodynamics, PMM-I, the state postulate, pure substance, simple compressible substances, specific heat, isothermal, isobaric, isentropic compressibility.	09
2.	Steady flow systems and their analysis, steady flow energy equation, enthalpy, first law for cyclic processes, applications, second law of thermodynamics, entropy and second law, thermodynamic reservoirs, various statements and their equivalence.	09
3.	Reversible cycle, Carnot cycle, efficiencies of reversible cycle, Carnot's theorem, Thermodynamic temperature scale, Clausius's theorem, entropy concept, inequality of Clausius's principle's of increase of entropy and its applications, second law for closed system, second law for open system, PMM-II.	08
4.	Concept of exergy, Gibb's function, Helmholtz function, relationship between specific heats, Clapeyron equations, thermodynamic relations for ideal gases (computation of entropy and internal energy from measurable quantities), process with ideal gases and vapours, Maxwell's equations.	08
5.	Calculations involving heat transfer, work transfer and change in thermodynamic properties with various processes, ideal gas mixture, various definitions, Dalton's law, Gibb's-Dalton's law, Amagat-Leduc law.	08
6.	Internal energy, enthalpy, specific heat and entropy of an ideal gas mixture, air water-vapour mixture, complete and incomplete combustion analysis, heating value of fuels, analysis of products of combustion, Orsat apparatus.	08
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Fundamentals of Engineering Thermodynamics	Moran. M.J. Shapiro	John Wiley,2005

S.No:	References Recommended	Author	Publisher
1.	Thermodynamics	Wark.K	McGraw Hill,2001
2.	Thermodynamics	Cengal. Y. Boles	*Mc-Graw Hill, 2001*
3.	Fundamentals of Classical Thermodynamics	Van-Wylen. GJ	*John Wiley, 2001*

Course Code: MEE-3517
Engineering Mathematics-III
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Laplace Transform, shifting Theorem, Laplace transforms of different functions, Heaviside's Unit function, Dirac Delta Function its Laplace transforms. Heaviside's Expansion Theorem, Inverse Laplace Transforms. Initial and final value theorems, Convolution theorem and Applications, Use of Laplace Transforms in the solution of linear Differential equations.	20
2.	Fourier Series, Harmonic Analysis, Definition of Fourier Transform, Fourier sine and cosine transform, Fourier integral Formula. Applications to solutions of boundary value problems.	15
3.	Definition, Linearity property, Z- Transform of elementary functions, Shifting Theorems. Initial and final value Theorem, Convolution theorem, inversion of Z-transforms.	15
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Advanced Engg. Mathematics	Erwin Kreyzing	Wiley Eastern Publication, 2009

S.No:	References Recommended	Author	Publisher
1.	Laplace Transforms	Murray R. Speigal	Schaum's Outline Series, 2008
2.	Advanced Engineering Mathematics	Greenberg. M.D	Prentice Hall of India, 2011
3.	Higher Engg. Mathematics	Grewal. B.S	Khanna Publications, 2012

Course Code: MEE-3617
Electrical Engineering Technology
Course Credits: 03

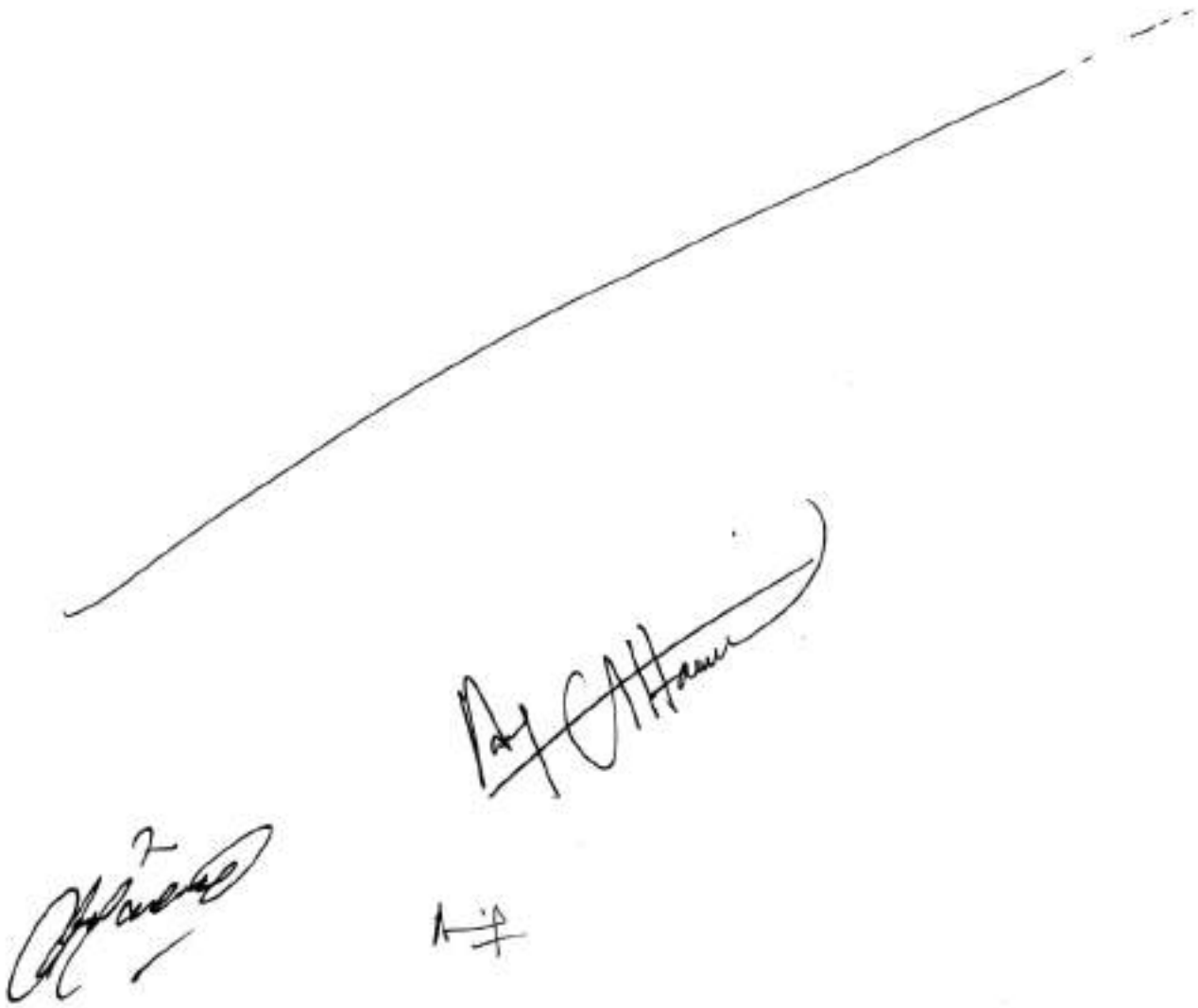
S.No:	Topic	No. of Hrs
1.	Transformers: Single Phase Transformers: Introduction, classification, construction, electromotive force (e. m. f.) equation, Equivalent circuit model, Phasor diagrams, Losses and efficiency, Voltage regulation, Transformer tests, Auto-transformers, Introduction to three phase transformers, Applications of transformers in mechanical engineering.	5
2.	Principles of Electromechanical Energy Conversion: Energy conversion via electric and magnetic fields, Field energy and mechanical force.	2
3.	D.C. Generator: Construction and principle of operation, emf equation of D.C. generator, characteristics of D.C. generators, losses condition for maximum efficiency, Applications of D.C. Generator.	4
4.	D.C. Motor: Working principle, voltage equation, torque developed, operating characteristics of D.C. motor, speed control methods, Application areas of D.C. Motors.	4
5.	Basic Concepts in A.C. Rotating Electrical Machines: The rotating magnetic field, Magneto-motive force and flux distribution, Induced voltage, Production of torque.	3
6.	Induction Machines: Construction, Types, Principle of operation of an induction machines, Equivalent circuit, Torque/speed characteristics, Speed control, Applications of induction machines.	4
7.	Single-Phase Motors: induction motors, universal motor, Schrage motor, Applications of single phase motors.	2
8.	Synchronous Machines: Construction & Types, working principle, applications.	2
9.	Definition of basic terms used in measurements.	1
10.	Electro-mechanical indicating instruments: Classification, effects utilized in measuring instruments, errors and their types, various forces in an electro-mechanical indicating instrument, various methods of damping.	2
11.	Transducers; Definitions, Types of transducers and their applications for mechanical measurements.	1
12.	Galvanometers, Ammeters and Voltmeters (PMMC, Induction, Electrostatic and Dynamometer type), mathematical theory of the D'Arsonval galvanometer, Ammeters and voltmeters: Meter range extension and their connections in their circuits.	3
13.	Bridge methods to measure; Resistance, inductance and capacitance; various types of bridges and their applications for measuring, R, L and C.	3
14	Measurement of power and energy; watt meters, measurement of power using Watt meters, energy meters and measurement of electrical using energy meters.	2
15	Digital Instruments; Introduction to digital meters for the measurement of various electrical quantities.	1
	Total number of Hours	39

Course Code: MEE-3617
Electrical Engineering Technology
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Transformers: Single Phase Transformers: Introduction, classification, construction, electromotive force (e. m. f.) equation, Equivalent circuit model, Phasor diagrams, Losses and efficiency, Voltage regulation, Transformer tests, Auto-transformers, Introduction to three phase transformers, Applications of transformers in mechanical engineering.	5
2.	Principles of Electromechanical Energy Conversion: Energy conversion via electric and magnetic fields, Field energy and mechanical force.	2
3.	D.C. Generator: Construction and principle of operation, emf equation of D.C. generator, characteristics of D.C. generators, losses condition for maximum efficiency, Applications of D.C. Generator.	4
4.	D.C. Motor: Working principle, voltage equation, torque developed, operating characteristics of D.C. motor, speed control methods, Application areas of D.C. Motors.	4
5.	Basic Concepts in A.C. Rotating Electrical Machines: The rotating magnetic field, Magneto-motive force and flux distribution, Induced voltage, Production of torque.	3
6.	Induction Machines: Construction, Types, Principle of operation of an induction machines, Equivalent circuit, Torque/speed characteristics, Speed control, Applications of induction machines.	4
7.	Single-Phase Motors: induction motors, universal motor, Schrage motor, Applications of single phase motors.	2
8.	Synchronous Machines: Construction & Types, working principle, applications.	2
9.	Definition of basic terms used in measurements.	1
10.	Electro-mechanical indicating instruments: Classification, effects utilized in measuring instruments, errors and their types, various forces in an electro-mechanical indicating instrument, various methods of damping.	2
11.	Transducers; Definitions, Types of transducers and their applications for mechanical measurements.	1
12.	Galvanometers, Ammeters and Voltmeters (PMMC, Induction, Electrostatic and Dynamometer type), mathematical theory of the D'Arsonval galvanometer, Ammeters and voltmeters: Meter range extension and their connections in their circuits.	3
13.	Bridge methods to measure; Resistance, inductance and capacitance; various types of bridges and their applications for measuring, R, L and C.	3
14	Measurement of power and energy; watt meters, measurement of power using Watt meters, energy meters and measurement of electrical using energy meters.	2
15	Digital Instruments; Introduction to digital meters for the measurement of various electrical quantities.	1
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Electric Machinery	Fitzgerald, Kingslay, Umans	Tata McGraw-Hill

S.No:	References Recommended	Author	Publisher
1.	Electric Machinery Fundamentals	Chapman	McGraw-Hill Higher Education
2.	Electric Machines	Nagrath and Kothari	Tata McGraw-Hill
3.	Electrical Measurements and Measuring Instruments	Golding	Widdis Pitman
4.	Electrical Electronic Measurements	A.K.Sawhney	Dhanpat Rai



Course Code: MEE-3117L
Mechanics of Materials-I Lab
Course Credits: 01

S. No:	Experiment
1.	Tensile test of mild steel and aluminum bars.
2.	Shear test on specimen of two different metals.
3.	Bending tests on a steel bar.
4.	Impact tests on metals: a) Izod Test b) Charpy Test.
5.	Torsion test on specimen of different metals for determining the angle of twist for a given torque.
6.	Hardness tests on metal to determine Brinell and Rockwell hardness.
7.	Buckling load for a column.
8.	Compressive test of a specimen.

Course Credits: MEE-3217L
Manufacturing Technology-I Lab
Course Credits: 01

S. No:	Experiment
1.	Testing molding sand for permeability, shear strength and compression strength.
2.	Percentage of cross- sectional area reduction by rolling and wire drawing.
3.	SMAW, welding parameters selection for MS strips.
4.	Study of lathe machine.
5.	Performing step turning and taper turning on lathe machine.
6.	Performing drilling and boring operations on lathe machine.
7.	Performing external thread cutting on lathe machine.
8.	Study of bench type drilling machine.
9.	Performing various operations like drilling, reaming, counter boring and countersinking on drilling machine.
10.	Study of a surface grinding machine performing surface grinding on washers.
11.	Study of dividing head and performing gear milling.

Course Code: MEE-3317L
Theory of Machines Lab
Course Credits: 01

S. No:	Experiment
1.	Study of kinematic pairs & working of stroboscope.
2.	Slider crank motion, reciprocating engine mechanism, Inversion of four bar chain, Oscillating cylinder mechanism and Whitworth quick return mechanism.
3.	Various models of brakes and Working of a clutch using clutch model.
4.	Study the characteristics of a Watt Governor.
5.	Study the characteristics of a Proell Governor
6.	Study the characteristics of a Porter Governor
7.	Study the characteristics of a Hartnell Governor
8.	Generation of involute gear tooth profile.
9.	Involute teeth in contact & interference and under cutting of gear and its significance.
10.	Study of pairs of cams and follower
11.	Determine the velocity of precession of a given motorized gyroscope.

Course Code: MEE-3617L
Electrical Engineering Technology Lab
Course Credits: 01

S. No:	Experiment
1.	To perform open circuit and short circuit tests on a single-phase transformer
2.	To perform polarity test on a single phase transformer
3.	To determine the efficiency and voltage regulation of a single phase transformer
4.	To study various parts of a dc machine and draw sketches of the same
5.	To plot the external characteristic of a dc shunt generator.
6.	To plot the external characteristics of a dc series generator.
7.	To plot the external characteristic of a dc compound generator.
8.	To study the different parts of an Induction motor.
9.	To determine the equivalent–circuit parameters of a 3 -ϕ Induction motor by (i) No load test (ii) Blocked rotor test
10.	To determine the Torque / speed characteristics of a 3-ϕ Induction motor
11.	To Study of the construction of a synchronous machine

Course Code: MEE-4117
Fluid Mechanics-I
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Definitions, fluids, types of fluids, continuum approach to stress, fluid properties, fluid statics, body and surface forces, stress at a point, state of stress in fluid at rest and in motion, pressure distribution in hydrostatics, manometers.	08
2.	Forces on plane and curved surfaces, buoyancy and the concept of stability of floating and submerged bodies.	05
3.	Scalar and vector fields, Eulerian and Lagrangian approaches, material derivative, velocity and acceleration, streamline, streak line and path line, deformation, rotation and vorticity, deformation rate and strain rate tensor, circulation.	07
4.	Continuity equation, momentum equation, energy equation, Euler's equation, Bernoulli equation, ideal fluids, Navier-stokes equations, exact solutions.	07
5.	Laminar boundary layer, boundary layer equations, Blausius flow, momentum-integral equation of boundary layer.	07
6.	Laminar-Turbulent Transition, Fluctuations, Turbulent boundary layer equations, Shear stress models.	06
7.	Universal velocity distribution law, pipe flow, friction factor, fully developed pipe flow, pipe bends, pipe losses, dimensional homogeneity and Rayleigh methods.	07
8.	Buckingham's theorem, typical non dimensional parameters, geometric, kinematics and dynamics similarity, model testing.	03
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Fluid Mechanics	White. F.M	McGraw-Hill, 2003

S.No:	References Recommended	Author	Publisher
1.	Fundamental of Fluid Mechanics	Munson. B.R	John Wiley, 2002
2.	Fluid Mechanics	Robert. W. Fox	John Wiley, 2009
3.	Introduction to Fluid Mechanics	Cengel.Y	McGraw Hill, 2001

Course Code: MEE-4217
Applied Engineering Thermodynamics
Course Credits: 04

S.No:	Topic	No. of Hrs
1	Carnot vapour power cycle, drawbacks as a reference cycle, Rankine cycle and its modification, *T-S* and *H-S* diagrams, Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles, Reheat Rankine cycle, Ideal and practical regenerative Rankine cycles, open and closed feed water heaters, Binary/multi-fluid cycles.	08
2.	Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. Equilibrium considerations, Combustion of fuels in boilers, power plant thermal efficiency, emissions,	08
3.	Steam boilers and their classification, subcritical and supercritical boilers, fluidized bed boilers, fire-tube and water-tube boilers, mountings and accessories.	08
4.	Flow through varying area, Convergent divergent nozzle and diffuser, Critical pressure ratio, Effect of variation of back pressure on nozzle performance, Effect of friction, Steam flow through nozzle: velocity of steam, discharge through the nozzle and condition for its maximum value, Equilibrium and super saturated steam flow through nozzles.	08
5.	Introduction to steam turbines, Impulse and reaction turbines, degree of reaction, Velocity diagrams & blade design, velocity and pressure compounding, Losses in Turbines, Overall efficiency, Stage efficiency and reheat factor, Polytrophic efficiency, Axial and radial flow steam turbines, Turbine control/governing.	08
6.	Steam Condensers, Classification of steam condensers and their analysis, Sources of air in condensers, Effects of air leakage in condensers, Methods of obtaining maximum vacuum in condensers, vacuum efficiency, condensers efficiency, Cooling ponds/ Cooling towers analysis, Environmental aspects of power plant operation.	10
Total number of Hours		50

S.No:	Text Books Recommended	Author	Publisher
1.	Applied Thermodynamics	Eastop. T.D	Pearson, 1990

S.No	References Recommended	Author	Publisher
1.	Principles of Turbomachinary	Turton. R.K	Chapman and Hall, 1997
2.	Marine Boilers	Flanagan. G.T.H	Elsevier, 1991
3.	Steam Plant Operation	Woodruff. E.V	Mc. Graw Hill, 1974
4.	Steam Turbine Theory and Practice	Kearton. W.J	CBS Publication, 1960

Course Code: MEE-4317

Engineering Mathematics-IV

Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Special functions: Solution of series, Legendre's functions, Rodriguess formula, generate functions for Legendre's, polynomials and recurrence formulae, Bessel's functions, recurrence formulae and Bessel's functions of integral order.	10
2.	Numerical solution of partial differential equations: Finite difference approximation of partial derivatives, solution of Laplace equations, solution of one dimensional heat flow equation by Crank Nicolson method.	10
3.	Advanced statistics: Testing hypothesis, null hypothesis, errors, level of significance, test of significance, confidence limits, test of significance of large samples, sampling distribution of the proportions.	15
4.	Estimation of the parameters of the population, comparison of large samples, T distribution, testing for difference between means of two small samples, Chi-square distribution.	15
Total number of Hours		50

S.No:	Text Books Recommended	Author	Publisher
1.	Advanced Engineering Mathematics	Jain and Iyenger	Narosa Publication, 2007

S.No:	References Recommended	Author	Publisher
1.	Higher Engineering Mathematics	Grewal. B.S	Khanna Publications, 2001
2.	Advanced Engineering Mathematics	Das. H.K	S. Chand &Co, 2007

Course Code: MEE-4417
Materials Science
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Introduction to material science and engineering, Why to study material science and engineering, classification of materials, modern and advanced materials, human needs and materials selection, and design considerations.	04
2.	Atomic structure and bonding, fundamentals of electron arrangements and modern periodic table, primary bonds and secondary bonds, energy related concepts, structure of metals and ceramics, concept of unit cells and lattice arrangements.	04
3.	Ceramic crystal structure and density computations, polymorphism and allotropy, crystal systems, crystallographic directions and planes, atomic densities (linear and planar), single crystals, polycrystalline materials anisotropy.	08
4.	X-ray diffraction and determination of crystal structures, polymer structure, hydrocarbon molecules, polymer molecules and their chemistry, molecular weight and shape and structure, thermoplastic and thermosetting polymers, imperfections in solids, point defects, line defects and volume defects.	10
5.	Grain size determination, diffusion mechanism, steady state diffusion, non steady state diffusion, factors that influence diffusion, diffusion in ionic and polymeric materials.	08
6.	Deformation and strengthening mechanisms, plastic deformation of polycrystalline metals, deformation by twining strengthen by grain size reduction.	08
7.	Phase diagrams, solubility limit, phases, micro-structure and phase equilibrium, dielectric materials, Gauss equations, electro-thermo elasticity.	08
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Fundamentals of Materials Science and Engineering	Callister. W.D	John Wiley & Sons, 2011

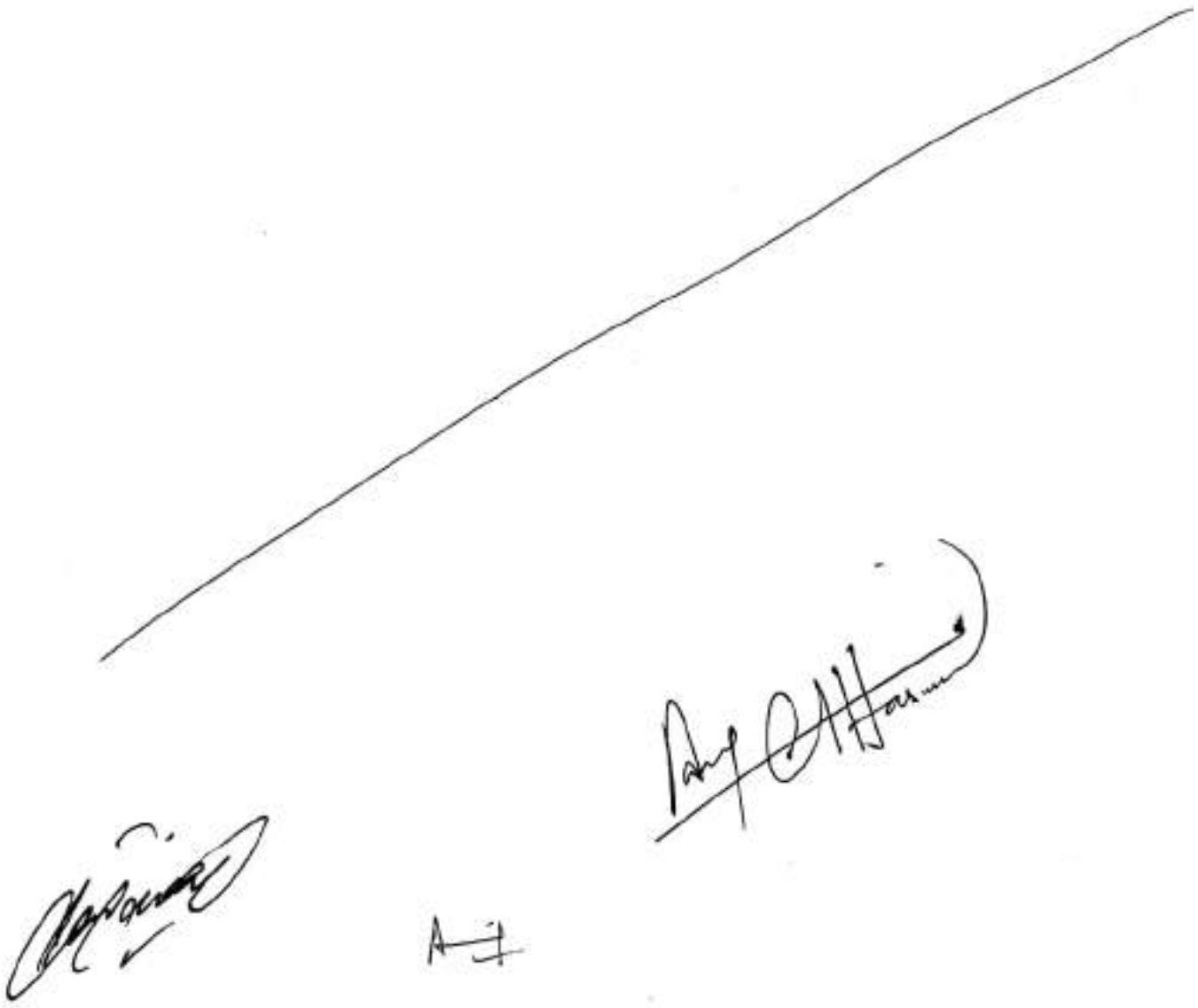
S.No:	References Recommended	Author	Publisher
1.	Physical Metallurgy	Cahn. R.W., Haasen. P.	North-Holland, 1991

Course Code: MEE-4517
Mechanics of Materials-II
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Analysis of statically indeterminate beams, Slope-Deflection Method, Slope-Deflection Equations, Basic Concept of the Slope-Deflection Method, Analysis of Continuous Beams, Moment-Distribution Method, Clapeyron's "three-moment" equation.	8
2.	Theories of failure, maximum principal stress theory, maximum principle strain theory, maximum shear stress theory, total strain energy theory, distortion energy theory, octahedral stress theory, Mohr's theory.	8
3.	Composite Beams, Transformed-Section Method, Doubly Symmetric Beams with Inclined Loads, Bending of Unsymmetrical Beams, The Shear-Centre Concept, Shear Stresses in Beams of Thin-Walled Open Cross Sections, Shear Stresses in Wide-Flange Beams, Shear Centres of Thin-Walled Open Sections.	8
4.	Energy methods, Principle of Virtual Work, Deflections of Beams by the Virtual Work Method, Conservation of Energy and Strain Energy, Castigliano's Second Theorem, Maxwell's Law of Reciprocal Deflections.	8
5.	Columns,Buckling and Stability, Types of inelastic instabilities, definition of critical load, Columns with Pinned Ends, Columns with Other Support Conditions, Columns with Eccentric Axial Loads, The Secant Formula for Columns, Elastic and Inelastic Column Behavior,Inelastic Buckling, initially bent members and eccentrically loaded columns.	8
6.	Thick cylinders, Lame's theory, Longitudinal, radial and circumferential stress, Maximum shear stress, Compound cylinders, Compound cylinders -graphical treatment, Shrinkage or interference allowance, Hub on solid shaft, Force fits, Uniform heating of compound cylinders of different materials, Wire-wound thick cylinders, Difference in treatment between thin and thick cylinders, Thick cylinder - internal pressure only, Comparison with thin cylinder theory, Graphical treatment, Thin cylinders under internal pressure, Hoop or circumferential stress, Longitudinal stress, Changes in dimensions, Thin rotating ring or cylinder, Thin spherical shell under internal pressure, Change in internal volume Vessels subjected to Fluid pressure, Cylindrical vessel with hemispherical end Effects of end plates and joints, Wire-wound thin cylinders. Rings, Discs and Cylinders Subjected to Rotation, Thin rotating ring or cylinder, Rotating disc with a central hole, Rotating thick cylinders or solid shaft, Rotating disc of uniform strength.	10
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Introduction to Solid Mechanics	I.H. Shames and J.M. Pitarresi	Prentice Hall of India, 1991

S.No:	References Recommended	Author	Publisher
1.	Mechanics of Materials	R. C. Hibbeler	Prentice Hall of India, 2009
2.	Mechanics of Materials	J.M. Gere and S.P. Timoshenko	Cengage Learning, 2001
3.	Engineering Mechanics of Solids	Popov. E. P	Prentice Hall of India, 2003



Course Name: MEE-4617
Industrial Engineering-I
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Concept of industrial productivity, Introduction and significance of Industrial engineering with brief explanation of its techniques, functions of industrial engineering, definitions and explanation of productivity with significance in industries, productivity measurements, factors affecting productivity, basic work content and excess work content, industrial applications to calculate total and partial productivities, introduction to work study and its basic procedures, definitions and concept of work study with examples, human factor in the application of work study, factors for selecting the work study, ergonomics, scope and objectives of ergonomics, application of human factors in engineering work place design, etc.	12
2.	Introduction to work study and basic procedures, method study, Record, examine and develop, process charts, and diagrams,outline PC, Flow process charts, two hand process charts, MAC, simo chart, flow diagram, string diagram, cycle graph, chronocycle graph, travel chart, the principles of motion economy.	15
3.	Work measurement and its applications, Time study, work sampling, rating and their methods, breaking the jobs into elements, types of elements, allowances and their calculations, calculation of standard time, examples of time study, PMT systems, synthetic data, various applications and examples.	12
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Motion and Time Study, Design & Measurement of Work	Barnes. R.L	John Wiley & Sons, 1990

S.No:	References Recommended	Author	Publisher
1.	Introduction to Work Study	International Labor Office, Geneva	Geneva, 1991

Course Code: MEE-4117L

Fluid Mechanics Lab

Course Credits: 01

S.No:	Topic
1.	To determine the viscosity of a fluid by falling sphere (ball) viscometer.
2.	Critical Reynolds number in pipe flow.
3.	Verification of the Bernoulli's theorem.
4.	To find co-efficient of discharge for Venturimeter.
5.	Calibration of a Rotameter.
6.	Measurement of velocity in the wind tunnel with Pitot static tube.
7.	Measurement of pressure with pressure sensors.
8.	Flow visualizations past bluff and streamline bodies in a smoke tunnel.
9.	Calculation of flow rate using an orifice meter.

Course Code: MEE-4217L

Applied Engineering Thermodynamics Lab

Course Credits: 01

S.No:	Topic
1.	Study of typical boiler.
2.	Calculation of dryness fraction of steam.
3.	Calculation of heat balance sheet of a boiler.
4.	Determination of COP of a refrigeration system.
5.	Study of cooling tower.

Course Code: MEE-4617L
Industrial Engineering-I Lab
Course Credits: 01

S.No:	Topic
1.	Ergonomic design study (present/proposed/new) of a product, equipment or work environment (human- machine interface).
2.	To assembly a product (electrical holder, etc.), record the cycle time and draw learning curve of the operator performing the assembly.
3.	Draw out line process chart and two hand flow process charts for the assembly performed in experiment no. 2, and analyze the present method and also suggest improved method/s.
4.	Study and draw of flow process charts (some suitable assembly operation).
5.	Study and draw multi activity chart of a suitable method and propose better method/s.(Man and machine).
6.	Study suitable movements/travel of man, material or equipment, and draw string diagram, travel chart and flow diagrams.
7.	To calculate the standard time of a suitable job, using predetermined time standard techniques.

Course Code: MEE-5117
Machine Design-I
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Introduction to design, need of design, types of loads, Failure criteria for fatigue loading, design of machine elements using Soderberg criteria, Gerber criteria, Goodman criteria.	09
2.	Rivets and welding: Loading, bending, direct shear, axial and bending, eccentric loading.	08
3.	Design of threaded fasteners and power screws, thread forms and threaded fastener types and materials, power screws, bolt tightening and initial tension, static and fatigue loading in bolts, bending and axial loading on a group of bolts.	08
4.	Design of springs: Spring materials, helical compression and extension springs, design for fatigue, loading, leaf springs, levers.	09
5.	Design of shafts, keys, pins and splines.	08
6.	Flanged joints, cotter joint, Knuckle joint, gib and cotter joint.	08
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Machine elements in Mechanical Design	Robert. L. Mott	Pearson Education, 2012

S.No:	References Recommended	Author	Publisher
1.	The Mechanical Design Process	David. G. Ullman	Tata McGraw Hill, New Delhi, 2001
2.	Design of Machine Elements	Bhandari. V.B	Tata McGraw Hill, New Delhi, 2007

Course Name: MEE-5217
Manufacturing Technology-II
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Brief history of NC and CNC machines, Introduction, open loop & closed loop CNC machines, classification of CNC machines, advantages of CNC machines, setup time reduction, introduction to CNC programming, adaptive control, machining parameters selection.	06
2.	Introduction to robotics and automated guided vehicles(AGV's), introduction to flexible manufacturing systems (FMS), elements of FMS and its advantages, cellular manufacturing, expert systems in manufacturing & simulation, maintenance automation.	06
3.	Mechanical working of materials, Hot and cold working, theory and principles, press forging, general principles of die design, forging defects, principles of metal rolling, hot and cold extrusion indirect and impact extrusion processes.	06
4.	Wire drawing and tube drawing and spinning, welding, selection of welding process, arc welding, resistance welding, submerged arc welding, GMAW, GTAW, thermit and friction welding technique.	08
5.	Introduction to unconventional machining processes, abrasive jet machining (AJM), abrasive water jet machining (AWJM), advantages and applications, ultra sound machining(USM), process variables and advantages, electro discharge machining (EDM).	06
6.	Process variables, metrology, limits, fits and tolerances, hole basis and shaft basis system, unilateral and bilateral system, Taylor's principles of gauge design, sine bars and gauge blocks manufacturing method and their applications, use of Dial indicators, comparators and coordinate measuring machine (CMM).	07
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Manufacturing science	Amitabh Ghosh and Asok kumar Mallik	Ellis Horwood Ltd, 1995

S.No:	References Recommended	Author	Publisher
1.	Fundamentals of Modern Manufacturing	Grover.P	Pearson Publications, 2001
2.	Production Engineering	Sharma.P.C	S. Chand Publication, 2005

Course Code: MEE-5317
Industrial Engineering-II
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Factory organization, Introduction to plant organization, principles of organizational structure, organization charts, types of organizations, developing an organization structure, results of good organization, informal organization, advantages and disadvantages, location and layout analysis.	06
2.	Introduction to Facility location problems, factors affecting the plant location, break even analyses and their application, subjective, qualitative and semi-quantitative techniques of facility location, single facility location problem, mini max location problem, gravity problem and their applications.	07
3.	Line balancing, Introduction to facility layout and their objectives, Classification of Layouts, with advantages and disadvantages of each, Layout design procedures(CRAFT,CORELAP,ALDEP), Material handling systems, Make or Buy decisions, Planning and control of Batch Production,. Characteristics of Batch Production, Determination of Batch size, Minimum Cost batch Size, Maximum Profit Batch size, Sequencing and scheduling for Batch Production, Line of Balance technique.	08
4.	Inspection and quality control: Concept and Definition of Quality, Concepts of Inspection and quality control, Objectives of inspection, Function of Inspection and their types, Concept of statistical quality control (SQC), Process variation, Sampling inspection. Concepts and types of Control charts, Acceptance sampling, application of control charts and sampling plans.	08
5.	Materials management and inventory control, Integrated materials management and their components, functions and objectives of material management, introduction and concepts of inventory management, purchase model with instantaneous replenishment and without shortage, manufacturing model without shortages, purchase model with shortages, manufacturing model with shortages, probabilistic inventory concepts with lead time, selective inventory management- ABC , FSN, VED analyses.	10
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Production and Operations Management	Everett. E.A and Ronald J.E	Prentice Hall of India, 1996

S.No:	References Recommended	Author	Publisher
1.	Statistical Quality Control	Grant. E.L and Leavenworth R.S	Tata McGraw Hill, 1998

Course Code: MEE-5417
Engineering Mathematics-V
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Complex numbers, functions, limits and continuity.	08
2.	Analytic functions, harmonic function, necessary and sufficient condition for a complex function to be analytic, polar form of Cauchy Riemann equations, construction of analytic functions.	10
3.	Power series, absolute convergence, some tests for convergence of power series, radius of convergence of a power series, sum function of a power series, Cauchy Hadamard Theorem.	10
4.	Complex Integration, Complex line integral, Cauchy's theorem, Cauchy's integral formula, Poisson's integral formula, Morera's theorem, Cauchy's inequality, Tailor's theorem, Liouvilles theorem, Laurents theorem and its uniqueness.	10
5.	Singularities, zero of a function, types of singularities, poles and zeros, limiting point of poles and zeros.	5
6.	Calculus of residues, residue at a pole, residue at infinity, Cauchy's residue theorem, residues at finite pole, conformal mapping, transformation, Jacobian of transformation, bilinear transformations, critical points, fixed points, cross ratio.	7
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Functions of a complex variable	Sharma. J.N	Krishna Prakashan Media, 1996

S.No:	References Recommended	Author	Publisher
1.	Complex variables and applications	Brown. J.W and Churchill. R.V	McGraw Hill, 2008

Course Code: MEE-5517
Measurements and Instrumentation
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Measurement and Instrumentation; definitions, significance, Fundamental methods, generalized measurement system, Functional elements, Types of input quantities, standards, calibration, uncertainty, Errors, Classification of instruments, Input-output configuration, Interfering and modifying inputs, methods of correction, Generalized performance characteristics, static characteristics, static calibration, Dynamic characteristics, zero and first order instruments, time constant, Second-order instruments, transient response characteristics.	08
2.	Relative and absolute motion devices, relative displacement, Resistive potentiometers, bridge circuit, LVDT, Variable inductance and variable capacitance pick-ups, Piezoelectric transducers, fibre optic displacement transducer, Resistance strain gage, Relative velocity-translational and rotational, Mechanical revolution counters and timers, stroboscopic method, Moving coil and moving magnet pickups, DC and AC tachometers, Eddy current drag-cup tachometer, acceleration measurement.	10
3.	Hydraulic and pneumatic load cells, flapper nozzle principle, Force transducers with elastic members, Proving ring transducer, cantilever beam transducer, electromagnetic balance, Dynamometers – Absorption, driving and transmission type, reaction forces in shaft bearings, prony brake, eddy current brake dynamometer.	10
4.	Instruments for high, mid and low pressure measurement, dead weight and null type, Elastic element gages, Differential pressure cell, high pressure measurement, Low pressure measurement , Pirani gages & McLeod pressure gauge. Orifice meters, Venturimeter, Pitot tube, Flow nozzle, Variable area meters, rotameter, design and accuracy.	05
5.	Positive displacement flow meter, turbine flow meter, Electromagnetic flow meter, ultrasonic flow meters, Temperature sensing techniques, liquid-in-glass and bimetallic thermometers, Pressure thermometers, electrical resistance thermometers, Thermistors, Thermocouples, thermopiles, Radiation pyrometers, Optical pyrometer.	06
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Mechanical Measurements	Beckwith. B	Pearson Education International, 2008

S.No:	References Recommended	Author	Publisher
1.	Instrumentation, Measurements & Analysis	Nakra. B.C	Tata McGraw Hill, 2000

Course Code: MEE-5617
Introduction to Mechanical Vibrations
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Force analysis of mechanisms, D'Alemberts principle, dynamic force analysis, equivalent dynamic system, dynamic analysis of reciprocating engines.	06
2.	Amplitude and phase angle of vibratory motion, phenomena of beats, non harmonic motions, harmonic analysis and analysis of free vibration.	06
3.	Forced vibration of systems without damping, equilibrium and energy methods for determining natural frequency, Rayleigh's Methods, equivalent systems, systems with compound springs, free vibrations of systems with viscous damping.	08
4.	Forced vibrations of system with viscous damping, equivalent viscous damping, power consumption in vibrating system, excitation of supports, transmissibility, vibration isolation and commercial isolators, principles of vibration, measuring instruments amplitude and phase shift response.	07
5.	Free un-damped vibration of two degree of freedom systems static and dynamic coupling, un-damped dynamic vibration absorber friction damper, approximate solution of vibration problems of light flexible shafts with and without damping.	08
6.	Free longitudinal vibrations of prismatic bars, torsional vibrations of circular shafts and transverse vibration of beams.	08
7.	Balancing of four-bar linkage and slider crank mechanism balancing of radial, in line, V-and locomotive engines.	07
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Mechanical Vibrations	Grover. G.K	Nem Chand and Bros, 1996

S.No:	References Recommended	Author	Publisher
1.	Theory of Vibrations with applications	Thomson. W.T	Pearson Education, 2010
2.	Elements of vibration analysis	Meirovitch	McGraw Hill, 2011

Course Credits: MEE-5217L
Manufacturing Technology-II Lab
Course Code: 01

S.No:	Topic
1.	Safety precautions and study of CNC lathe machine.
2.	Performing step turning on CNC lathe machine.
3.	Performing taper turning on CNC lathe machine.
4.	Performing radius turning on CNC lathe machine.
5.	Performing multiple turning cycles on CNC lathe machine.
6.	Performing pattern repetition cycle operation on CNC lathe machine.
7.	Performing linear cuts and circular cuts on CNC milling machine.
8.	Performing linear and circular cuts using subroutines.
9.	Performing pocket milling.
10.	Use of sine bars and slips gauges for angle measurement.
11.	Use of bevel protector and dial gauges.

Course Credits: MEE-5317L
Industrial Engineering-II Lab
Course Code: 01

S.No:	Topic
1.	To study the layout of a shop in an organization and draw existing and proposed layouts.
2.	To measure the variable characteristics (diameter of pins, with micrometer) and prepare a frequency histogram. Calculate values of X bar and sigma.
3.	Verify that when random samples are taken from a lot with a certain percentage of defective, same %age lands to appear in random sampling by using Shewart's kit.
4.	Simulate an inspection situation with the help of a Schewhart's bowl and plot X bar, and R charts using computed data.
5.	To conduct Process capability study of a machine tool and to specify the tolerances for a job.
6.	To verify the theorem "the standard deviation of the sum of any number of independent variables is the square root of the sum of the squares of the S.Ds of the independent variable. Determine statistically, the permissible tolerance of mating components, when the tolerance of the assembly is given.
7.	To draw control chart for percent defectives after inspecting a sample and sorting out the defective units.

Course Code: MEE-5617L
Introduction to Mechanical Vibrations-Lab
Course Credits: 01

S.No:	Topic
1.	Study of whirling of shafts
2.	To verify the relation $t = 2\pi \sqrt{l/g}$
3.	To verify radius of gyration 'K' of given pendulum.
4.	To verify the radius of gyration of given bar by using Bi-linear suspension.
5.	To study longitudinal vibrations of helical spring and to determine the frequency or period of vibrations (oscillation) theoretically and actually by experiment.
6.	To study the undamped free vibration of equivalent spring mass system.
7.	To study the forced vibration of equivalent spring mass system.
8.	To study the torsional vibration (undamped) of single rotor shaft system.
9.	To study the free vibration of two rotor system and to determine the natural frequency of vibration theoretically and experimentally.
10.	To study the damped torsional excitations and determine the damping coefficient.
11.	To study the forced lateral vibrations of the beam for different damping.

Course Code: MEE-6117
Automatic Control
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Introduction to Control Systems, Examples of Control Systems, Closed-Loop Control Versus Open-Loop Control.	01
2.	Mathematical Modelling of Control Systems, Inertial and Non-inertial frames of reference.	04
3.	Transient and Steady-State Response Analyses First-Order Systems, Second-Order Systems, Higher-Order Systems, Performance characteristics of control systems.	06
4.	Basic Control Actions Effects of Proportional, Derivative and Integral Control actions on system performance, Steady-State Errors in Unity-Feedback Control Systems.	08
5.	Stability Asymptotic Stability, Bounded Input Bounded Output (BIBO) Stability, Routh's Stability Criterion.	06
6.	Control Systems Analysis and Design by the Root-Locus Method.	06
7.	Control Systems Analysis and Design by the Frequency-Response Methods	08
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Modern Control Engineering	Ogata. K	Prentice Hall, 2010

S.No:	References Recommended	Author	Publisher
1.	Automatic Control	Raven. F	McGraw Hill, 1998

Course Code: MEE-6217
Machine Design-II
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Couplings, rigid couplings, muff couplings, flange couplings and flexible couplings.	10
2.	Design of sliding bearings, bearing materials, fluid viscosity, hydrodynamic lubrication, Petroff's equation, Raimondi and Boyd chart, Heat dissipation. Rolling elements bearings: Types, catalogue information (Timken and SKF bearings), bearing life radial and thrust loads.	10
3.	Rope drive, belt drive and chain drive.	05
4.	Gear design, spur, helical and worm gears, gear tooth profile, gear geometry, module, contact ratio, gear train, gear tooth bending strength, gear tooth surface fatigue analysis, gear material.	15
5.	Clutches and brakes: Single and multiple plate clutch, wear and constant pressure theories for plate clutches, materials, and shoe drum brakes, internal and external shoe brakes.	10
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Mechanical Engineering Design	Shigley. J.E and Mitchell. L.D	Tata MCGraw Hill, International, 2011

S.No:	References Recommended	Author	Publisher
1.	A Text Book of Machine Design	Khurmi. R.S and Gupta. J.K	S Chand & Co. Ltd., New Delhi, 2010
2.	Machine Design	Qasim. S.Z	Khanna Publishers (P) Ltd., Delhi, 1998

Course Code: MEE-6317
Heat Transfer
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundary conditions of 1st, 2nd and 3rd kind Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.	09
2.	Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, and short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Conduction in solids with negligible internal temperature gradient (Lumped system analysis).	09
3.	Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numerical based on empirical relation given in data handbook. Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres.	10
4.	Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere.	08
5.	Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers.Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations.	08
6.	Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two finite surfaces-configuration factor or view factor	06
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Fundamentals of Heat and Mass Transfer	Incropera and Dewitt	John Wiley, 2009

S.No:	References Recommended	Author	Publisher
1.	Fundamentals of Heat and Mass Transfer	Kothandaraman. C.P.	New Age International Publishers, 2007
2.	Fundamentals of Engineering Heat and Mass Transfer	Sachdeva. K.C	New Age International Publishers, 2009
3.	Heat Transfer	Holman. J.P	Tata McGraw Hill, 1998

Course Code: MEE-6417
Linear Optimization in Engineering
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Overview of Operations Research (OR), OR Methodology and techniques, Introduction to Linear Programming (LP), Application of LP techniques in Production management, graphical solutions, the simplex method.	10
2.	Duality and Sensitivity analysis, transportation model problems and their variants, assignment model problems.	10
3.	Project planning and scheduling, CPM & PERT, Project crashing and recourse allocation problems.	08
4.	Decision theory, steps in decision making, decision making under uncertainty and under risk, marginal analysis, decision trees.	08
5.	Flow shop scheduling, Job shop scheduling, Queuing theory and their applications.	08
6.	Waiting line models and their applications, introduction and basic concepts of Simulation.	06
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Operation Research- an Introduction	Taha. H.A	Prentice Hall of India, 2000

S.No:	References Recommended	Author	Publisher
1.	Introduction to Operations Research	Joseph Ecker and Michael K	John Wiley & Son, 1998

Course Code: MEE-6517
Fluid Machinery
Course Credits: 04

S.No.	Topic	No. of Hrs.
1.	Introduction to Turbo machinery, Types of Turbo machines, Equations Governing the Behavior of Turbo machines, Continuity Equation, Linear Momentum Theorem, Angular Momentum Equation, the Energy Equation, and dimensional Analysis. Dimensionless Groups and Specific Speed, Graphical Correlations for Specific Speed. Efficiency of Compressors, Polytropic or Small-Stage Efficiency, Nozzle Efficiency, Diffuser Efficiency.	05
2.	Turbines: Classification of Turbines, Impulse Turbines-Pelton Wheels, Reaction turbine, Francis turbine, main components, design of spiral casing guide vanes, runner and number of runner blades, types of Francis runners, Kaplan turbine, velocity diagram power and efficiency calculations, draft tube, cavitation factor, Governing of reaction turbines. Principles of similarity: unit and specific quantities, performance characteristics, selection, of water turbines, hydro-electric power plants.	06
3.	Radial-Flow Turbines, Propeller and Kaplan Turbines Effects of Rotor and Guide-vane Angle Selection of Speed and Runner Dimensions, Turbine Characteristics.	06
4.	Inlet and Outlet Elements of Turbine, Surge Tanks, Basic Equations for Differential Surge Tanks, Spiral casing, Instability of the Surge Tank, Draft Tubes.	02
5.	Radial-flow Pumps, Geometry, Power Theoretical Head, Energy Losses, Head Losses, Leakage Losses, Disk Friction Loss, Mechanical Losses, Specific Speed and Impeller Geometry Modeling of Flow through an Impeller, Axisymmetric Flow, Net Positive Suction Head (NPSH), Slip Factors, Effect of Blade Number, Outlet Blade Angle, and Circulation in Blade Passages, Choice of Blade Number and Blade Overlap .	06
6.	Mixed-flow Pumps, Axial and Semiaxial Pumps, Pump Characteristics of Centrifugal Pumps, Series and Parallel Connections, Displacement Rotary Pumps, Flow Control, Reciprocating Pumps.	03
7.	Inlet and Outlet Elements of pumps, Volute Design, Velocity Distributions in Different Volute Cross Sections, Design of a Volute, Relation between Volute Velocity and Specific Speed	02
8.	Head Losses in Components of Turbine and Pump Systems, Pipes , Friction Factor, Hydraulic Diameter, Cavitation in Turbines and Pumps, Water Hammer.	05
9.	Centrifugal Compressors and Fans: Centrifugal Compressor, The Effect of Blade Shape on Performance, Velocity Diagrams, Slip Factor, Work Done, Diffuser, Compressibility Effects, Mach Number in the Diffuser, Centrifugal Compressor Characteristics, Stall, Surging, Choking.	05
10.	Axial Flow Compressors and Fans: Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients, Cascade Nomenclature and Terminology, Consideration, Multi-Stage Performance, Axial Flow Compressor Characteristics.	05
11.	Reciprocating Compressors, Reciprocating Compressors including Clearance, Volumetric efficiency, Multi-stage compression, Steady flow Analysis.	05
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Incompressible Flow Turbomachines	Round. G.F	Elsevier, 1990

S.No:	References Recommended	Author	Publisher
1.	Principles of Turbomachinary	Turton. R.K	Chapman and Hall, 1993
2.	Turbomachinery Design and Theory	Rama S. R. Gorla, Aijaz A. Khan	Marcel Dekkeirnc, 2003
3.	Hydraulic Machines: Turbines and Pumps	Grigori Krivchenko	Lewis Publishers, 2004
4.	Mechanics of Fluid	Massey. B.S	Van Nostrand Reinhold co, 1968
5.	Hydroelectric Engineering Practice	Guthrie and Brown	CBS Publishers, New Delhi, 1993

Course Code: MEE-6317L

Heat Transfer Lab

Course Credits: 01

S.No:	Topic
1.	Determination of fin efficiency and effectiveness of a pin fin in forced convection and natural convection.
2.	Determination of thermal conductivity of a plate by two slab guarded hot plate method.
3.	Determination of thermal conductivity of pipe insulation and insulation powder.
4.	Determination of thermal conductivity of a liquid by the guarded hot plate method.
5.	Determination of thermal conductivity of a good conductor of heat (metal rod).
6.	Determination of overall resistance of a composite wall.
7.	Determination of heat transfer coefficient in forced convection through a horizontal tube.
8.	Determination of heat transfer coefficient for heat vertical cylinder in natural convection.
9.	Determination of LMTD and NTU in parallel flow and counter flow heat exchanger.
10.	Determination of Stefan Boltzmann's constant.
11.	Determination of emissivity.

Course Code: MEE-6517L
Fluid Machinery-Lab
Course Credits: 01

S.No:	Topic
1.	Study of Pelton Turbine.
2.	Study of Francis Turbine.
3.	Study of Hydraulic pumps.
4.	Study of different types of compressors.

Course Code: MEE-7117
Compressible Fluid Flow
Course Credits: 04

S.No:	Topic	No. of Hrs
1	Basics of Compressible flow: Velocity of sound, Compressibility effects in fluids and Mach number, isentropic flow, stagnation & critical conditions, normal shock waves, quasi-ID steady isentropic flow through a variable area passage.	08
2.	Review of Basic Equation in Differential and Integral Form (Mass, Momentum and Energy) for a viscous compressible flow and equations of states, Basic differential equations for an inviscid compressible flow Dynamic similarity parameters in a compressible viscous flow.	08
3.	Steady One Dimensional Flow Model-Basic Equations, Normal Shock Waves (Stationary), Oblique Shock Waves, Reflection & Interaction of Oblique Shock Waves, Expansion Waves Adiabatic Flow in a Constant area passage with friction, frictionless flow in a constant area passage with heat addition/removal.	06
4.	Quasi-ID Steady Flows-Adiabatic Flow in a variable area passage without friction, Convergent-divergent nozzles and their operating characteristics. Convergent-divergent Supersonic Diffusers, Generalized Quasi-ID Flow Governing Equations.	06
5.	Unsteady wave motion Moving normal shocks, reflected shock waves, Physical aspects of wave propagation, Basic elements of acoustic theory. Finite (Non-Linear) waves, Shock-tube relations, Finite compression waves.	06
6.	Introduction to 2-Dimentional Compressible Flow Velocity considerations, velocity potential, linearized solutions, method of characteristics, numerical solutions.	06
7.	Gas power cycles, Otto cycle, Diesel cycle, Atkinson Cycle, Ericsson cycle, Brayton cycle,	04
8.	Flow through nozzles and diffusers, Gas turbines cycles, Modification to basic cycles, constant pressure combustion gas turbine, open cycle and closed cycle gas turbines, Constant volume combustion turbine, Jet propulsion, Turbojet, Turboprop, Ramjet, Rocket Propulsion	06
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Modern Compressible Flow with Historical perspective	John. D Anderson	McGraw Hill, 2012
2.	Applied Thermodynamics for Engineers and Technologists	Eastop and Mckonkey	Pearson, 2009
3.	Compressible Flow	Yahya. S.M	New Age Science, 2010

S.No:	References Recommended	Author	Publisher
1.	The-Dynamics-and Thermodynamics of Compressible Fluid-Flow	Ascher H Shapiro	Ronald Press Company, 1980
2.	Gas turbine theory	Cohen, Rogers and Saravanamuttoo	PHI, 1997

Course Code: MEE-7217
Internal Combustion Engines
Course Credits: 04

S.No.	Topic	No. of Hrs
1.	Classification of engines according to fuels, cycle of operation and number of strokes, construction details, value arrangements, application of IC engines, review of air standard cycles, deviation of actual cycles from fuel air cycles, various influencing factors.	08
2.	Review of fuels for IC engines with particular reference to velocity, ignition quality and knock rating, variable compression ratio engines. Air-fuel ratios and mixture requirements of SI engines, stoichiometric fuel air ratio, lean and rich mixture operation, optimum conditions, carburetors—principle, types and venturi, fuel orifice sizes, charge stratification and distribution. Fuel-air requirement in CI engines.	08
3.	Methods of fuel oil distribution and injection. Types of injector systems in SI and CI engines. Flame front and normal combustion. Detonation in SI and knocking CI engines. Factors influencing detonation and knock. Comparative analysis. Ignition systems in SI and CI engines.	06
4.	Engine friction and lubrication: Effect of engine variables, total engine friction, requirements of lubricants and lubricating systems.	06
5.	Cooling systems: Gas temperature variation, heat transfer rates, piston and cylinder temperature, heat rejected to coolant, air and water cooling systems and components. Two-stroke engines: Special features, scavenging systems.	08
6.	Supercharging: Objects, effects on engine performance, supercharging limits, methods of supercharging with special emphasis on turbochargers.	06
7.	Engine testing and performance: Various performance parameters and their measurements. Air pollution from engine exhaust, its measurement and control, principle constituents of engine, emission methods of control, modification of conventional engines, dual fuel and multifuel engines, stratified charged engines, sterlings engines, Wankel rotary combustion engine.	08
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Internal Combustion Engines	John B. Heywood	Tata McGraw Hill, New York, 1998

S.No:	References Recommended	Author	Publisher
1.	Internal Combustion Engines	Gupta. H.V	Prentice-Hall of India (P) Ltd., New Delhi, 2006
2.	Internal Combustion Engines	Ganeshan. V	Tata McGraw Hill, New Delhi, 1998

S.No:	Text Books Recommended	Author	Publisher
1.	Internal Combustion Engines	John B. Heywood	Tata McGraw Hill, New York, 1998

S.No:	References Recommended	Author	Publisher
1.	Internal Combustion Engines	Gupta. H.V	Prentice-Hall of India (P) Ltd., New Delhi, 2006
2.	Internal Combustion Engines	Ganeshan. V	Tata McGraw Hill, New Delhi, 1998

Course Code: MEE-7317
Numerical Techniques
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Overview of MATLAB, solutions of non linear equations, bisection method, secant method, Newton-Raphson method. Method of successive approximations.	06
2.	Concept of synthetic division, Bairstow's method, Muller's method, Quotient difference method, convergence of iterative methods.	08
3.	Solution of system of linear equations, Gauss Elimination Method, Gauss Jordan Method, Matrix Inversion Method, Crout's Method. Iterative methods, Jacobi's Method, Gauss Siedel Method. Solutions of homogenous system of linear equations, Eigen Value Problem, power method.	08
4.	Interpolation and approximation of functions, forward, backward, divided and central differences. Newton's methods of interpolation, Gauss's Interpolation formulas. Estimation of errors in interpolation.	08
5.	Curve fitting (straight line, nonlinear, exponential), Multiple regressions.	06
6.	Numerical Differentiation of graphical and tabulated functions, higher order derivatives. Numerical Integration, Simpson's rule, Weddle's, Trapezoidal rule, adaptive integration, double integration and improper integrals.	07
7.	Numerical solutions of ordinary and partial differential equations, Runge Kutta Methods, finite difference methods.	07
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Numerical Methods	Veerarajan	Tata Mc-GrawHill, 2000

S.No:	References Recommended	Author	Publisher
1.	MATLAB Programming	Pratap. R	Narosa publishers, 2001
2.	Numerical Methods	Sastry.S	Prentice Hall of India, 2000

Course Code: MEE-7417
Introduction to Mechatronics
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Introduction to mechatronics, mechatronic design approach, system interfacing, instrumentation and control systems microprocessor-based controllers and microelectronics, Mechatronics, a new directions in nano-, micro-, and mini-scale, electromechanical systems design, physical system modelling, electromechanical systems structures and materials, modelling of mechanical systems for mechatronics applications,	9
2.	Sensors and actuators, fundamentals of time and frequency, sensor and actuator characteristics, linear and rotational sensors, acceleration sensors, force measurement, torque and power measurement, flow measurement, temperature measurements, distance measuring and proximity sensors, light detection; image, and vision systems, integrated micro-sensors, actuators; electromechanical actuators, electrical machines, piezoelectric actuators; hydraulic and pneumatic actuation systems.	10
3.	Micro transducers analysis, design and fabrication, role of controls in mechatronics, role of modeling in mechatronics design, response of dynamic systems, introduction to computer and logic systems.	10
4.	Logic concepts and design system interfaces, communication and computer networks, fault analysis in mechatronic systems, logic system design, programmable logic controllers, software and data acquisition.	10
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Mechatronics system design	Shetty. D and Richard A.K	Cengage learning, 2011

S.No:	References Recommended	Author	Publisher
1.	Mechatronics	Dan. S.N	Prentice Hall, 2002

Course Code: MEE-7517
Power Plant Engineering
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Energy source for generation of electric power, principle types of power plants, their special features and applications, major power plants in India, steam power plants.	04
2.	Selection of site, general layout of the power plant, special features of the modern steam boilers, circulation principle, steam separation and purification, economizers and air pre-heater types and estimation of performance, super-heater and superheat control, feed water heaters, cooling tower, temperature and pressure control, introduction to hydro electric power plant.	05
3.	Types of hydro-electric plant in combination with steam plant, runoff river plant in combination with steam plant, storage plant in combination with steam or nuclear plant, coordination of hydro-electric and gas turbine stations, coordination of different types of power plants.	06
4.	Nuclear Power Plants, Nuclear fuel, nuclear energy by fission, main components of nuclear reactors, pressurized water, boiling water, liquid metal and gas nuclear reactors.	06
5.	Diesel power plants: plant layout, two and four stroke cycle diesel engines, fuel injection, lubrication and cooling systems, supercharging and starting systems, gas and steam turbine combined cycles, simple gas and steam combined cycle power generation.	06
6.	Economic Analysis of Power Plants and Tariffs, The cost of electrical energy, selection of types of generating equipment, performance and operating characteristics of power plant, load division among generators, tariff methods of electrical energy.	06
7.	Combined operation of different power plants, Advantages of combined working, load division among power stations, storage.	06
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Applied Energy Conversion	Skrotzki. B.G.A, William. A.V	McGraw-Hill Book Company, inc., 1945

S.No:	References Recommended	Author	Publisher
1.	Power Plant Engineering	Domkundwar. S	S.C. Chand and company, 1996
2.	Modern Power Plant Engineering	Joel .W and Roy. E	Prentice-Hall of India Ltd, 1998

Course Code: MEE-7117L
Compressible Fluid Flow-Lab
Course Credits: 01

S.No:	Topic
1.	Study of the various types of wind tunnels.
2.	Study of fluid flow over aerofoils.
3.	Study of Normal and Oblique shocks.
4.	Study of convergent divergent nozzle.
5.	Shock tube.
6.	Fanno Flow.
7.	Rayleigh Flow.

Course Code: MEE-7217L
Internal Combustion Engines-Lab
Course Credits: 01

S.No:	Topic
1.	Study of two stroke spark ignition engine model.
2.	Study of four stroke spark ignition engine model.
3.	Study of four stroke diesel engine model.
4.	Study of rotary wankel engine.
5.	Study of models of gas turbine engines.
6.	Study of single cylinder four stroke direct injection diesel engine. (cut section)
7.	Study of multi-cylinder optical spark ignition engine.
8.	Experimental study of characteristic performance curves of spark ignition engine using gasoline as fuel.
9.	Experimental study of characteristic performance curves of compression ignition engine using diesel as fuel.
10.	Experimental study of characteristic performance curves of compression ignition engine using biodiesel blends, with diesel as fuel.
11.	Study of engine components (cylinder block, crank shaft etc).
12.	Study of components of ignition system of S.I. Engines.

Course Code: MEE-8117
Refrigeration and Air Conditioning
Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Principles of refrigeration – Carnot refrigeration cycle – Various methods of producing cold, Performance parameters – capacity – Coefficient of performance (COP), Refrigeration systems – Vapour compression system –Classification of Vapour absorption system – Air cycle refrigeration – Steam jet refrigeration – thermo electric cooling and magnetic refrigeration, Introduction to liquefaction systems Cascading – simple Linde Hampson system – Claude cycle liquefier.	08
2.	Vapour compression refrigeration system – theoretical and practical cycles – simple and multipressure systems – thermodynamic analysis, System components – Compressors – Reciprocating compressors – single and multistage compressors – work of compression – effect of clearance – effect of inter-cooling – optimum pressure ratio – efficiencies – rotary compressors – screw type and vane type compressors – hermetic, semi hermetic and open compressors, condensers – water cooled and air cooled condensers – evaporative condensers, expansion devices – capillary tube – constant pressure expansion valve – thermostatic expansion valve – float valve, evaporators – natural.	08
3.	Vapour absorption system – principle of operation of aqua – ammonia and lithium bromide – water systems – electrolux system – comparison between vapour compression and absorption systems, Refrigerants – thermodynamic, physical and chemical properties of refrigerants – Selection criteria of refrigerants, designating refrigerants.	08
4.	Psychrometry – psychrometric processes – Requirement of air conditioning – human comfort – comfort chart and limitations – effective temperature – factors governing effective temperature – design considerations – inside design condition, ventilation standards, Applied psychrometry, summer air conditioning processes, winter air conditioning processes, round the year air conditioning systems.	08
5.	Cooling load calculations – various heat sources – solar load – equipment load – infiltration air load – duct heat gain – fan load – moisture gain through permeable walls and fresh air load, design of air conditioning systems – Duct design – equal friction – static regain and velocity reduction methods – distribution systems – insulation, central and unitary systems. Air conditioning equipments and control systems – air filters – humidifiers – fan – blowers – control systems for temperature and humidity – noise and noise control.	08
6.	Working of summer, winter and all year round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning. Components of refrigeration and air conditioning systems Working of reciprocating, screw and scroll compressors, working of air cooled, water cooled and evaporative condensers, Working of DX, Flooded, Forced feed evaporators, Expansion devices – Capillary tube, TXV, EXV, operating and safety controls	10
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Refrigeration and Air Conditioning	Arora. C.P	Tata McGraw Hill, 1996

S.No:	References Recommended	Author	Publisher
2.	Refrigeration and Air conditioning	Stockers W.F and Jones J.W.	McGraw Hill international edition, 2006
3.	Basics of refrigeration and Air Conditioning	Ananthanarayana	Tata McGraw Hill, 1997

Course Code: MEE-8217

Fundamentals of Tribology

Course Credits: 04

S.No:	Topic	No. of Hrs
1.	Introduction to Tribology, Contact between bodies in relative motion, Friction due to adhesion, ploughing and deformation, Energy dissipation during friction, Friction under complex motion conditions, Types of wear and their mechanisms, Adhesive wear, Abrasive wear, Wear due to surface fatigue, Wear due to chemical reactions, Sliding contact between surface asperities, The probability of surface asperity contact, Wear in lubricated contacts, Rheological lubrication regime, Functional lubrication regime, Fractional film defect, Load sharing in lubricated contacts.	08
2.	Friction, Lubrication and Wear of Lower Kinematic Pairs, The concept of friction angle, Friction in slideways, Friction stability, Friction in screws with a square thread, Application of a threaded screw in a jack, Plate clutch - mechanism of operation, Cone clutch - mechanism of operation, Driving torque, Boundary lubricated sliding bearings, Axially loaded bearings, Pivot and collar bearings, Drives utilizing friction force, Belt drive, Mechanism of action.	08
3.	Adhesive wear equation, Fatigue wear equation, Relation between fracture mechanics and wear, Estimation of stress intensity under non-uniform applied loads, Film lubrication, Coefficient of viscosity, Fluid film in simple shear, Viscous flow between very close parallel surfaces, Shear stress variations within the film, Lubrication theory by Osborne Reynolds, High-speed unloaded journal, Equilibrium conditions in a loaded bearing, Loaded high-speed journal, Equilibrium equations for loaded high-speed journal, Reaction torque acting on the bearing, The virtual coefficient of friction, The Sommerfeld diagram.	08
3.	Tribological problems in machine design: Plain sliding bearings, Rolling contact bearings, Piston, piston rings and cylinder liners, Cam and cam followers, Friction drives, Involute gears, Hypoid gears, Worm gears, surface roughness, RMS value, average value and ten point average of surface roughness and measurement of surface roughness. Frictional aspects of brake design, The band brake, The curved brake block, The band and block brake, The role of friction in the propulsion and the braking of vehicles.	08
4.	Tribodesign aspects of mechanical seals, Wear in mechanical seals. Friction, lubrication and wear in higher kinematic pairs, Loads acting on contact area, Traction in the contact zone, Hysteresis losses, Rolling friction, Lubrication of cylinders, Analysis of line contact lubrication, Heating at the inlet to the contact, Analysis of point contact lubrication, Cam-follower system.	08
4.	Sliding element bearings, Derivation of the Reynolds equation, Hydrostatic bearings, Squeeze-film lubrication bearings, Thrust bearings, Flat pivot, The effect of the pressure gradient in the direction of motion, Equilibrium conditions, The coefficient of friction and critical slope, Journal bearings, Geometrical configuration and pressure generation, Mechanism of load transmission, Thermoflow considerations, Design for load-bearing capacity, Unconventional cases of loading, Short bearing theory, Journal bearings for specialized applications, Dynamically loaded journal bearings, Minimum oil film thickness, Modern developments in journal bearing design, Tilting-pad bearing characteristics, Design features of hydrostatic thrust bearings, Self-lubricating bearings, Rolling-contact bearings, Analysis of friction in rolling-contact bearings, Friction torque due to gyroscopic spin, Friction torque due to elastic hysteresis, Lubrication of rolling-contact bearings, Function of a lubricant, Solid film lubrication, Grease lubrication, Jet	10

	lubrication, Surface failure modes related to lubrication, Lubrication effects on fatigue life, Elasto hydrodynamic lubrication in design practice.	
	Total number of Hours	50

S.No:	Text Books Recommended	Author	Publisher
1.	Introduction to Tribology	Bushan. B	John Wiley, Tribology Series, 2013

S.No:	References Recommended	Author	Publisher
1.	Engineering Tribology	Stachowiak. G.K Batchelor. A.W	Elsevier, 1993
2.	A system approach to science and Technology of Friction, Lubrication and Wear	Czichos.H	Elsevier Publications,1978
3.	Friction, Wear and Lubrication	Ludema. K.C	CRC Press, 1996

Course Code: MEC-80*
Introduction to MEMS
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Definition of MEMS, MEMS devices, Silicon as a MEMS material, mechanical properties of silicon, Fabrication technologies, Introduction to micro-fabrication, Silicon based MEMS processes, Surface Micromachining, Sacrificial Etching Process, Bulk Micromachining and Silicon Anisotropic Etching, Bulk versus surface micromachining, mechanical components in MEMS.	10
2.	Review of essential electrical and mechanical concepts, Conductivity of Semiconductors, Review of solid mechanics for design of mechanical components, Crystal Planes and Orientation, Mechanical properties of Silicon and their related thin films.	10
3.	Review of electrostatics and electrodynamics for electrical domain calculations, Electrostatic Sensing and actuation, analysis of comb drives.	10
4.	Dynamics of comb drives, Piezoelectric Sensing and actuation, Piezoresitive Sensing, Scaling laws, Instrumentation for MEMS testing and characterization.	09
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Microsystem Design	Senturia. S.D	Kluwer Academic Publisher, 2000

S.No:	References Recommended	Author	Publisher
1.	An Introduction to Micro Electromechanical Systems Engineering	Nadim. M	Artech house,1999

Course Code: MEC-80*
Introduction to Acoustics
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Fundamentals of Vibrations: Introduction, The simple oscillator, Complex exponential method of solution, Transient response of an oscillator, Power relations, Equivalent electrical circuits for oscillators, The Fourier Transform. Transverse Motion: Vibrations of extended systems, Transverse waves on a string, The one dimensional wave equation, General solution of the wave equation, The wave nature of the general solution, Initial values and boundary conditions, Reflection at a boundary, Forced vibration of an infinite string, Forced vibration of a string of finite length, Normal modes of the fixed string, Acoustic measurements.	10
2.	The Two-Dimensional Wave Equation: Vibrations of a plane surface, The wave equation for a stretched membrane, Free vibrations of a rectangular membrane, Free vibrations of a circular membrane, Normal modes of membranes, The diaphragm of a condenser microphone, Vibration of thin plates. The Acoustic Wave Equation and Simple Solutions: The equation of state, the equation of continuity, The Euler's equation, The linear wave equation, Speed of sound in fluids, Harmonic plane waves, Energy density, Acoustic intensity, Specific acoustic impedance, Spherical waves, The inhomogeneous wave equation, The point source.	10
3.	Radiation and reception of acoustic waves: Radiation from a pulsating sphere, Acoustic reciprocity and the simple source, The continuous line source, Radiation from a plane circular piston, Radiation impedance, Fundamental properties of transducers (directional factor, beam pattern, beam width, source level, directivity).	10
4.	Reflection and Transmission of Acoustic Waves: Transmission from one fluid to another: normal incidence, and oblique incidence, Normal specific acoustic impedance, Reflection from the surface of a solid: normal incidence, oblique incidence.	09
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Fundamentals of Acoustics	Kinsler, Frey, Coppens, and Sanders,	John Wiley and Sons, 2000

S.No:	References Recommended	Author	Publisher
1.	Theoretical Acoustics	Philip. M. Morse, Ingard. K.U	Princeton University Press,1999

Course Code: MEC-80*
Value Engineering
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Introduction to value engineering (VE) & value analysis (VA), Life Cycle of a product, Methodology of VE, Reasons for the existence of unnecessary costs. Quantitative definition of Value, use Value and Prestige value, Estimation of product Quality/Performance, Types of functions, Relationship between use functions and Esteem Functions in product design, Functional cost and functional worth, Effect of value improvement on profitability, Tests for poor value, Aims of VE systematic approach.	10
2.	Elementary introduction to VE, Job plan functional approach to value improvement, Various phases and techniques of the job plan, Factors governing project selection, Types of projects, Life cycle costing for managing the total value, concepts in LCC, Present value concept, Annuity concept, net present value, Pay Back period, internal rate of return on investment (IRR), Examples and Illustrations. Creative thinking and creative judgement, positive or constructive discontent, Tangible and intangible costs of implementation, False material, Labour and overhead saving, VE/VA yardsticks, Relationship between savings and probability of success, Reliability Estimation, system Reliability, Reliability elements in series and parallel.	10
3.	PHASES AND TECHNIQUES OF VE JOB PLAN: General Phase, Information phase, Function phase, Creativity/Speculation Phase, Evaluation Phase, Investigation Phase and Recommendation Phase: Value improvement recommendation theory, determination of cut-off point (cop), road blocks in implementation.	10
4.	Decision Matrix/Evaluation Matrix, Quantitative comparison of Alternatives, Estimation of weights factors and efficiencies, Utility transformation functions, Bench marking, Perturbation of weight factors (sensitivity analysis), and Examples. FAST Diagramming: Critical path of functions, HOW, WHY & WHEN Logic, Supporting and all time functions.	09
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Value Engineering- A Systematic Approach	Mudge. A.E	McGraw Hill, 2000

S.No:	References Recommended	Author	Publisher
1.	Techniques of value Analysis and Engineering	Miles. L.D	McGraw Hill, 2007

Course Code: MEC-80*
Theory of Elasticity
Course Credits: 03

S.No:	Topic	No. of Hrs
1.	Introduction, Elasticity, stress components of stress and strain, Hooks law, equations in polar coordinates, plane stress and plane strain, strain at a point	08
2.	Mohr circle for strain rosette, differential equation of equilibrium, boundary conditions, compatibility equations, overview of Airys stress functions.	08
3.	Two dimensional problems in rectangular coordinates, solution by polynomials, St.Venants principles, determination of displacement, bending of beams, solution by Fourier series.	06
4.	Two dimensional problems in polar coordinates: equations in polar coordinates, equation about 1-axis, and pure bending in curved bars.	06
5.	Determination of strains and displacement, Effect of circular hole on stress distribution in plate concentrated and vertical loading of a straight boundary, circular disc, general solution and its applications, analysis of stress and strain in three dimensions.	06
6.	Stress at a point, principal stress, stress ellipsoid and stress director surface, homogenous deformation, strain at a point, principle strain rotation.	05
	Total number of Hours	39

S.No:	Text Books Recommended	Author	Publisher
1.	Theory of Elasticity	Timoshenko. S.P and Goodier. J.N	McGraw Hill Book Company, 2001

S.No:	References Recommended	Author	Publisher
1.	The Mathematical Theory of Elasticity	Love. A.E.H	Dover Publications, 1995

Course Code: MEE-8117L
Refrigeration and Air-conditioning-Lab
Course Credits: 01

S.No:	Topic
1.	Test on Domestic Refrigerator for evaluation of EER.
2.	Test on vapor compression test rig.
3.	Test on air conditioning test rig.
4.	Test on ice plant test rig.
5.	Visit to Vapor absorption refrigeration plant.
6.	Estimation of cooling load of simple air conditioning system (case study).
7.	Case study on cold storage.
8.	Visit to any air conditioning plant.
9.	Thermal analysis of refrigeration cycle using suitable software.
10.	Installation and servicing of split air conditioner.