SYLLABUS

FOR

B.TECH. PROGRAMME

IN

MECHANICAL ENGINEERING

INSTITUTE OF TECHNOLOGY
ZAKURA CAMPUS
UNIVERSITY OF KASHMIR
SRINAGAR J&K, 190006

COURSE STRUCTURE FOR
B.Tech1st Semester Mechanical
AT UNIVERSITY OF KASHMIR

CourseCode	CourseTitle	TeachingPeriodsperweek			Credits
		L	*T*	*P*	
MTH-1117	**EngineeringMathematics-I**	3	1	0	4
CHM-1217	**EngineeringChemistry**	2	1	0	3
ELE-1317	**BasicElectricalEngineering**	2	1	0	3
CSE-1417	**IntroductiontoComputing**	2	1	0	3
HUM-1517	**CommunicationSkills**	2	0	0	2
MEE-1617	**EngineeringGraphics&Drawing**	1	3	0	4
CHM-1217L	**EngineeringChemistryLab**	0	0	4	2
ELE-1317L	**BasicElectricalEngineeringLab**	0	0	4	2
CSE-1417L	**IntroductiontoComputingLab**	0	0	4	2
	Total	**12**	**7**	**12**	**25**

COURSE STRUCTURE FOR
B.Tech 2nd Semester Mechanical
ATUNIVERSITY OF KASHMIR

CourseCode	CourseTitle	TeachingPeriodsperweek			Credits
		L	T	P	
MTH-2117	**EngineeringMathematics-II**	2	1	0	3
PHY-2217	**EngineeringPhysics**	2	1	0	3
ECE-2317	**BasicsofElectronicsEngineering**	2	1	0	3
CSE-2417	**ComputerProgramming**	2	1	0	3
MEE-2517	**EngineeringMechanics**	2	1	0	3
PHY-2217L	**EngineeringPhysicsLab**	0	0	4	2
CSE-2417L	**ComputerProgrammingLab**	0	0	4	2
ECE-2317L	**ElectronicsEngineering-Lab**	0	0	4	2
MEE-2617W	**WorkshopPractice**	0	0	8	4
	Total	**10**	**5**	**20**	**25**

COURSE STRUCTURE FOR
B.Tech 3rd Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE -3117	Fundamentals of Dynamics	2	1	0	3
MEE -3217	Mechanics of Materials -I	3	1	0	4
MEE -3317	Fluid Mechanics	2	1	0	3
MEE- 3417	Basic Engineering Thermodynamics	2	1	0	3
MEE-3517	Manufacturing Technology-I	2	1	0	3
MEE-3617	Machine Drawing & Computer Modelling	0	2	2	3
MTH 3717	Mathematics-III	2	1	0	3
MEE-3217L	Mechanics of Materials -I Lab.	0	0	2	1
MEE-3317L	Fluid Mechanics Lab.	0	0	2	1
MEE- 3517L	Manufacturing Technology - I Lab.	0	0	2	1
	Total	**13**	**8**	**8**	**25**

COURSE STRUCTURE FOR
B.Tech 4th Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE- 4117	Materials Science	2	1	0	3
MEE-4217	Mechanics of Materials- II	3	1	0	4
MEE-4317	Theory of Machines -I	3	1	0	4
MEE- 4417	Applied Thermodynamics-I	2	1	0	3
MEE- 4517	Manufacturing Technology -II	3	1	0	4
ELE- 4617	Electrical Engineering Technology	2	1	0	3
MEE-4317L	Theory of Machines-I Lab.	0	0	2	1
MEE- 4417L	Applied Thermodynamics-I Lab.	0	0	2	1
MEE- 4517L	Manufacturing Technology –II Lab	0	0	2	1
ELE- 4617L	Electrical Engineering Technology Lab.	0	0	2	1
	Total	**15**	**6**	**8**	**25**

COURSE STRUCTURE FOR
B.Tech 5th Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE- 5117	Theory of Machines -II	3	1	0	4
MEE- 5217	Machine Design- I	3	1	0	4
MTH 5317	Mathematics -IV	2	1	0	3
ECE- 5417	Industrial Electronics	2	1	0	3
MEE- 5517	Heat Transfer	2	1	0	3
MEE- 5617	Industrial Engineering-I	3	1	0	4
MEE- 5117L	Theory of Machines II-Lab.	0	0	2	1
MEE- 5417L	Industrial Electronics Lab	0	0	2	1
MEE- 5517L	Heat Transfer Lab	0	0	2	1
MEE5617L	Industrial Engineering Lab	0	0	2	1
	Total	**15**	**6**	**8**	**25**

COURSE STRUCTURE FOR
B.Tech 6th Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE- 6117	Measurement and Instrumentation	3	1	0	4
MEE- 6217	Machine Design-II	3	1	0	4
MEE-6317	Fundamentals of Tribology	3	1	0	4
MEE-6417	Linear Optimization in Engineering	3	1	0	4
MEE-6517	Introduction to Mechatronics	3	1	0	4
MEE-6617	SEMINAR	0	0	6	3
MEE-6317L	Fundamentals of Tribology Lab.	0	0	2	1
MEE-6517L	Mechatronics-Lab.	0	0	2	1
	Total	**15**	**5**	**10**	**25**

COURSE STRUCTURE FOR
B.Tech 7th Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE- 7117	Hydraulic Machinery	2	1	0	3
MEE- 7217	Automatic Control	2	1	0	3
MEE- 7317	Industrial Engineering-II	2	1	0	3
MEE- 7417	Applied Thermodynamics- II	2	1	0	3
MEE- 7517	Computer Applications in Mech. Engineering. (CAME)	2	1	0	3
MEE-7317L	Industrial Engineering- II Lab.	0	0	2	1
MEE-7517L	CAME Lab.	0	0	2	1
MEE- 7617	Final Year Project	0	0	10	5
MEE- 7717	Practical Training & Professional	0	0	6	3
	Total	**10**	**5**	**20**	**25**

COURSE STRUCTURE FOR
B.Tech 8th Semester Mechanical
AT UNIVERSITY OF KASHMIR

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
MEE- 8117	Production & Operations Management	3	1	0	4
MEE- 8217	Internal Combustion Engines	3	1	0	4
MEE- 8317	Departmental Elective- I	2	1	0	3
MEE-8417	Departmental Elective - II	2	1	0	3
MEE- 8517	Final Year Project	0	6	8	10
MEE- 8217L	I.C. Engine Lab.	0	0	2	1
	Total	**10**	**10**	**10**	**25**

ELECTIVE- I		ELECTIVE - II	
Course Code	**Course Title**	**Course Code**	**Course Title**
MEE 80*	Value Engineering	MEE 80#	Power Plant Engineering (PPE)
MEE 80*	Theory of Elasticity (TOE)	MEE 80#	CAD of Thermal systems
MEE80*	Introduction to Acoustics	MEE80#	Introduction to MEMS
MEE 80*	HVAC		
MEE 80*	Fracture Mechanics		

MTH-1117
Engineering Mathematics-I

UNIT-I

Calculus: Differential calculus of functions of several variables, partial differentiation, homogeneous functions and Euler's theorem, Taylor's and Maclaurin's series, Taylor's theorem and mean value theorem for functions of two variables, errors and approximations.

UNIT-II

Application's 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, curve tracing.

UNIT-III

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, formulae involving del applied to product of point function, line, surface and volume integrals.

Text Books:

1. Kreyszig E., "Advanced Engineering Mathematics", 8th Ed., *John Wiley* (2001).
2. Jain, R.K. and Iyengar S., "Advanced Engineering Mathematics", 2nd Ed., *Narosa Publishing House* (2003).
3. Das & Mukherjee, "Differential Calculus", *U.N. Dhur & Sons Pvt. Ltd.* (2008).
4. Das & Mukherjee, "Integral Calculus", *U.N. Dhur & Sons Pvt. Ltd.* (2011).

CHM-1217

Engineering Chemistry

UNIT-I

Electrochemistry: Reduction potentials, redox stability in water, the diagrammatic presentation of potential data, the effect of complex formation on potentials, electrolyte and non-electrolyte solutions, kinds of electrodes, concentration cells, the lead storage cell and fuel cell, laws of photochemistry, photo physical processes, fluorescence and phosphorescence, photochemical reactions: photolysis of HI, photochemical reaction between H_2 and Br_2, rotational and vibrational spectroscopy-principles and application to simple molecules, magnetic resonance UV-visible spectro-photometry, electronic transitions & electronic spectra, application to simple systems (analysis of Fe, Cu, Cr), Bear-Lambert's law & its applications. IR spectroscopy – IR spectrum, application of IR spectra (alcohols, acids, phenols, concept of vibrational spectra).

UNIT II

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, pollution: air pollution, natural and man-made pollutants (CO_x, NO_x, HC, SO_x, acid rains), effect of pollutants on human and plant life, sources and classification of water pollutants (organic, inorganic, sediments, radioactive materials, heat), 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, de-mineralization by ion exchange process).

UNIT III

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, 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, electron transfer.

Text Books:

1. Shriver D.F. and Atkin A.W., "Inorganic Chemistry", 3rd Ed., *Oxford Press* (1999).

2. Castellan G W "Physical Chemistry", 3rd Ed., *Narosa Publishing House* (1995).
3. Puri, Sharma & Kalia, "Inorganic chemistry", (2012).
4. Puri, Sharma & Pathania "Principles of Physical chemistry", (2012).
5. Skoog D.A., and Holles F.J., "Principles of Instrumental Analysis", 5th Ed., *Hercaurt Asia PTE Ltd.*, (2001).
6. Hill J.W. "Chemistry for changing times", 6th Ed., *Macmillan*, Canada (1995).
7. J.C. Kuriacose & J. Rajaraman, "Chemistry in engineering and technology", Volume-I & II, *Tata McGraw Hill Publishing Company Ltd.*, (2010).
8. P.C. Jain, "Engineering Chemistry", *Dhanpat Rai & Sons*, Nai Sarak, (2015).
9. C.V. Agrawal, "Chemistry of Engineering materials", *Tata Publishing Works*, (2006).
10. L.A. Munro, "Chemistry in engineering", *Prentice Hall*, (2008).

ELE-1317
Basic Electrical Engineering

UNIT-I

D. C. Circuits: Ohm's law, Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL), circuit parameters (resistance, inductance and capacitance), series and parallel combinations of resistance, inductance and capacitance. ideal and practical voltage and current sources and their transformation, dependent voltage sources and dependent current sources, power and energy relations, analysis of series parallel D.C. circuits.

UNIT-II

Network topology: basic electric circuit terminology, nodes, junctions, paths, loops, branches, formation of incidence matrices, tie-set and cut-set formation, network theorems: linearity & superposition, source transformations, Thevenin's and Norton's equivalent circuit analysis, maximum power transfer, reciprocity & Millman's theorem, loop and nodal methods: nodal analysis, mesh analysis, super node, super mesh, delta-star(Y) transformation

UNIT-III

A.C. Circuit analysis: Basic terminology and definitions: behavior of capacitors and inductors to A.C., Basic RL, RC and RLC circuits and their step response, phasor and complex number representations, phasor relations for R, L & C, impedance, admittance parameters, solutions of sinusoidal excited, RC circuits, power and energy relation, sine A.C. circuits, concept of a 3 phase voltage, star (Y) and delta circuits, current and voltage relations in star and delta circuits.

Text Books:

1. W.H. Hayt, J.E. Kemmerly, S.M. Durbin, "Engineering Circuit Analysis", *Tata McGraw Hill* (2012).
2. Del Torro, "Electrical Engineering Fundamentals", 2nd Ed, *Prentice Hall of India Pvt. Ltd.*, (1994)
3. B.C. Theraja, "Principles of Electrical Engineering" (2006).
4. Kothari D.P. and Nagrath I.J., "Basic Electrical Engineering", *Tata McGraw Hill*, (2010).

CSE-1417
Introduction to Computing

UNIT-I

Computer organization: Computer and processor abstraction, generations of computers, hardware organization of computers, central processing unit, memory, types of primary memory, secondary storage, devices and their types, input devices and their types, output devices and their types, various types of ports and their specifications and usage, review of basic digital and analog signals, binary number system and digital arithmetic, digital coding schemes, microprocessors, microcontrollers, CPU, GPU, various applications of computers in aerospace, agriculture, finance, medical, media, industries and commerce.

UNIT-II

Operating systems and networking: Computer software and its various types, types of system and application software, file and directory operations on windows, DOS and Linux operating systems, use of various tools and utilities in Windows and Linux, fundamentals of networking, internet, and various services offered through the internet: LAN, PAN, WAN, SAN, VPN, WWW, INTERNET, INTRANET, email, search engines, introduction to various networking devices, OSI model, TCP/IP protocol stack.

UNIT-III

Introduction to programming and problem solving: Types of programming languages, machine level, assembly level, high level language, algorithms, flow charts, compilation, assembling linking and loading, testing and debugging documentation, algorithms for GCD (greatest common division) of two numbers, test whether a number is prime or not, sorting numbers, finding square root and factorial of a number, generation of Fibonacci sequence, finding largest number in an array, evaluation of a polynomial.

Text Books:

1) P.K. Sinha and P. Sinha, "Foundation of Computers", *BPB Publishers* (2014).
2) C.V Rajaraman, "Fundamentals of computers", *PHI publishers* (2015).

HUM-1517
Communication Skills

UNIT I

Communication: Meaning, its types, significance, process, channels, barriers to communication, making communication effective, role in society, business correspondence: elements of business writing, business letters, components and kinds, memorandum, reports writing, purchase order, quotation and tenders, job application letters, resume writing etc, discussion meeting and telephonic skills: group discussion, conducting a meeting, attending telephonic calls, oral presentation and role of audio visual aids, grammar: transformation of sentences, words used as different parts of speech one word substation, abbreviations, technical terms etc.

UNIT II

Reading Skills: Process of reading, reading purposes, models, strategies, methodologies, reading activities, writing skills: elements of effective writing, writing style, scientific and technical writing, 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.

UNIT III

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, resume writing, report writing, conducting a meeting, minutes of meeting, oral presentation, group discussion.

Text Books:

1. Rodriques M.V., "Effective Business Communication", *Concept Publishing Company*, 1992, reprint (2000).
2. Bhattacharya, Indrajit, "An Approach to Communication Skills", *Dhanpat Rai Co., Pvt. Ltd.*, (2005).
3. Wright, Chrissie, "Hand book of Practical Communication Skills", *Jai co. Publishing House*, (1996).
4. Gartside L., "Modern Business Correspondence", *Pitman Publishing*, (2012).
5. Day, Robert A., "How to Write and Publish Scientific Paper", *Cambridge University Press*, (1996).

MEE-1617
Engineering Graphics & Drawing

UNIT I

Introduction to Engineering drawing: Equipment and drafting tools, symbols and conventions in drawing, types of lines and their use, material section representation, introduction to dimensioning, using any available CAD software to draw simple machine parts and blocks, use of various fundamental commands to edit a drawing, e.g. erase, copy, mirror offset, array, move, trim, use of features, extrude, extrude cut and revolve, projection of points: projection of points in the first, the second, the third and the fourth quadrant, 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 PP, line inclined to both the planes.

UNIT II

Projections: 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, projection of solids in first and third quadrant, axis parallel to one and perpendicular to other, section of solids: definition of Sectioning and its purpose, procedure of sectioning, application of few typical examples, development of surfaces: purpose of development, parallel in method, insertion of new planes and drawing necessary features on the plane, sectioning and obtaining sectioned views, dimensioning 2D drawing and labeling.

UNIT III

Orthographic projections of simple machine parts: Drawing of blocks and machine parts, isometric projection: basic principle of isometric projection, isometric projection of simple machine parts for which orthographic views are given, introduction to temporary and permanent fasteners, representation of screw threads and threaded fasteners, rivets and riveted joints, welding symbols, introduction to shaft couplings and bearings: assembly of various components of universal coupling and Oldham's coupling, types of bearings, assembly of various components of bushed bearing and foot step bearing.

Text Books:

1. Gill P.S., "Engineering Graphics and Drafting", *Katria and Sons*, Delhi (2001).
2. Bhat N.D., "Elementary Engineering Drawing-Plane and Solid Geometry", *Chartota Publishing House*, (1988).
3. Naryana K.L. and Kanaiah P., "Engineering Graphics", *Tata McGraw Hill Publishing Company Limited*, New Delhi (1992).
4. Luzzadde Warren J., "Fundamentals of Engineering Drawing", *Prentice Hall of India Private Limited*, (1988).

5. K. Venkatta Reddy, A textbook of Engineering Drawing, *BS Publications* New Delhi, 2nd Edition, (2004).
6. Introduction to Engineering Graphics: A Drawing Workbook, *Wits University Press*, (2000).
7. M. Prabhu, Engineering Graphics, *John Wiley publications limited,* (2005).

CHM-1217L
Engineering Chemistry Lab

The students are required to conduct experiments on following practical work:

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 amount of sodium hydroxide and sodium carbonate in a mixture.
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.

ELE-1317L
Basic Electrical Engineering Lab

The students are required to conduct experiments on following practical work:

1. To get familiar with the working knowledge of the following instruments:
   i. Digital storage oscilloscope
   ii. Cathode ray oscilloscope (CRO)
   iii. Multimeter (analog and digital)
   iv. Function generator
   v. Power supply.
2.
   i. To study power supply in constant current and constant voltage mode, study of current limiting in power supplies series and parallel combination of power supplies.
   ii. Measurement of various parameters (voltage, frequency) of a signal on DSO/CRO. Hands on with controls like volts/division, time/division, trigger, X_{mag}, positioning, time and voltage cursor measurements, saving and recalling of waveforms.
   iii. Measurement of resistance, capacitance, voltage, current, continuity, frequency using bench type/hand held multimeter.
   iv. Hands on with different controls (frequency, type of wave form, D.C. offset, duty cycle) of function generator.
3. Verification of Ohm's law for D.C. and A.C. circuits
4. Verification of KVL and KCL.
5. Verification of Thevenin's and Norton's theorem.
6. Verification of maximum power transfer theorem.
7. Calculation of RMS, peak to peak, average value of an A.C. signal using DSO/CRO.
8. To plot the resonance curve for a series and parallel resonance.
9. Measurement of current, voltages and power in R-L-C series circuit excited by (single phase) AC supply.

CSE-1417L
Introduction to Computing Lab

UNIT I

Introduction to computer organization: Familiarity with internal hardware organization of the computer viz. processor, RAM, ROM, hard disk, CD-ROM., motherboard, CPU, fan, buses, etc., familiarity with various types of I /O ports, office automation tools

MS Excel:

a) Getting data into MS Excel
b) Manipulating data in MS Excel
c) Working with MS Excel functions, formulae and charts
d) Problem solving using MS Excel
e) Solving engineering problems using MS Excel

UNIT II

Operating systems and networking: Familiarity with various versions of windows, virtual machines (Virtual Box / VM Ware, accessing various run commands of windows for faster and tricky access, familiarity with various flavors of Linux operating systems like Ubuntu, Fedora, etc., and usage of simple Linux commands, familiarity with networking devices like switch, hub, POE (power over ethernet), LAN Cable, LAN Connector, Ethernet card, office automation tools

Ms Access:

a) Getting data into MS Access.
b) Manipulating data in MS Access
c) Problem solving using MS Excel
d) Solving engineering problems using MS Excel

UNIT III

Introduction to problem solving: Writing algorithms and drawing flow charts for stated problems.

MTH-2117
Engineering Mathematics-II

UNIT I

Ordinary and Linear Differential Equations: Formation of ordinary differential equations, solution of first order differential equations by separation of variables, 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.

UNIT II

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, 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.

UNIT III

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, Baye's theorem, random variables and distribution: random variables, probability distribution, probability density function, discrete and continuous distributions - binomial, poisson, normal distributions, measure of central tendency and dispersion, sampling distribution, standard error, Central limit theorem.

Textbooks:

1. E. Kreyszig, "Advanced Engineering Mathematics", *John Wiley* (2003).
2. R. K. Jain &S. R. K.Iyengar, "Advanced Engineering Mathematics", *Narosa Publishing House* (2014).
3. Frank Ayres, "Matrices", *Tata McGraw Hills* (2003).
4. Malik & Arrora, "Advanced Mathematical Analysis", *S. Chand & Co* (2002).

PHY-2217
Engineering Physics

UNIT-I

Vectors and Electrostatics: Work and energy in electrostatics, dielectrics, polarization, electric displacement, susceptibility and permittivity, Clausius-Mossotti equation, transformation of vectors, spherical and cylindrical coordinates system, gradient of a scalar, 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 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.

UNIT-II

Electrodynamics: Electromotive force, Faraday's law, Maxwell's Equations, wave equation,Poyntingvector, 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,interference and diffraction:interference and principle of super position, Theory of bi-prism, interferences from parallel thin film, wedge shaped films, Newton strings, 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.

UNIT-III

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, Quantum theory: the Compton effect, matter waves, group and phase velocities, Uncertainty principle and its application, time independent and time dependent, 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).

Text Books:

1. Griffiths D., "Introduction toElectrodynamics",2nd Ed., *Prentice Hall of India*, (1998).
2. Beiser, "Perspective of Modern physics"5thEd.,*McGraw-Hill Ltd.*,(2002).
3. Arya A.P."Elementary Modern Physics"*Addison-Wesley*, Singapore (2006).
4. Mani, H.S.and Mehta G.K."Introduction to Modern Physics", *Affiliated East WestPress*,(2012)

ECE-2317
Basic of Electronics Engineering

UNIT I

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, Fermi level, EHP's, 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, P-N junctions, contact potential, equilibrium Fermi levels, space charge at junctions, current components at a junction, majority and minority carrier currents.

UNIT II

Diodes: Volt-ampere characteristics, capacitance of P-N junctions, diode as a circuit element, half wave, full wave, rectifiers, centre, tapped and bridge rectifiers, working, analysis and design, C-filter analysis, zener and avalanche breakdown- zener diodes, volt-ampere characteristics, regulated power supplies, IC based regulated power supplies, tunnel diodes, tunneling phenomenon, volt-ampere characteristics, varactor diodes, photo diodes, detection principle, light emitting diodes, volt-ampere characteristics.

UNIT III

Transistors: Bipolar junction transistors, NPN and PNP transistor action, open circuited transistor, biasing in active region, majority and minority carrier distribution, terminal currents, operation, characteristics, 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.

Text Books:

1. Semiconductor Physics and Devices, Basic Principlesby Donald E. Neaman, *McGraw-Hill Publishing*, 3rd Edition, 2003.
2. Physics of Semiconductor Devices by S.M. Sze, John Wiley and Sons, 2nd Edition, 1981.
3. Solid State Electronic Devices by B. G. Streetman, *Prentice Hall of India Ltd*, N. Delhi, 5th Edition, 2000.
4. Electronic devices and circuits by R. Boylsted and L. Nashelsky, *Prentice Hall Publications*, 7th Edition 2004.
5. Electronic devices by Floyd, *Pearson Education*, 7thEdition, 2008.
6. Electronic Principles: Malvino,*Tata McGraw Hill*,2012.

CSE -2417
Computer Programming

UNIT I

Introduction to "C" Language: 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, simple "C" programs, conditional statements and loops, decision making within a program, conditions, relational operators, logical connectives, *if* statement, *if-else* statement, loops: *while* loop, *do while loop*, *for* loop, Nested loops, Infinite loops, S*witch* statement, structured programming.

UNIT II

Arrays: One dimensional arrays, 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, 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.

UNIT III

Structures and Unions: Structure, nested structure, structures and functions, structures and arrays, arrays of structures, structures containing arrays, unions, pointers, address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, arrays and pointers, pointer arrays, file processing, concept of files, file opening in various modes and closing of a file, reading from a file, writing on to a file, introduction to object oriented programming with C++, objects and classes, object hierarchy, inheritance, polymorphism, introduction to advanced C/C++ compilers viz. ellipse/net beans.

Textbook:

1) E. Balaguruswamy, "Programming with ANSI-C", 2003
2) Byron Gottfried, "Programming with C", 2002
3) A. Kamthane, "Programming with ANSI & Turbo C", 2006
4) H. Schildt, "C++: The Complete Reference", 2013.
5) B. Stroustrup, "The C++ Programming Language", 2014.

MEE-2517
Engineering Mechanics

UNIT I

Introduction: System of forces, co-planar concurrent force system, composition and resolution of forces, equilibrium of rigid bodies, free body diagram, Lami's theorem, stress and strain, concept of stress and strain, simple stresses, tensile, compressive, shear, bending and torsion, stress-strain curves, elongation of bars, composite bars, thermal stresses, elastic constants, Mohr's circle.

UNIT I

Centre of Gravity and Moment of Inertia: Concept of centre of gravity and centroid, position of centroid, theorem of parallel and perpendicular axes, moment of inertia of simple geometrical figures, analysis of framed structure, reaction in different types of beams with different end conditions, bending moment and shear stress diagrams, determination of reactions in members of trusses: a) analytical method b) graphical method.

UNIT III

Physical Properties of fluids: System, extensive and intensive properties: specific, vaporability and vapor pressure, Newtonian and Non-Newtonian fluids, fluids statics: pressure, hydrostatic law, Pascal's law, different types of manometer and other pressure measuring devices, determination of meta centric height, fluid kinematics and dynamics: classification of fluids, streamline, streak line and path lines, flow rate and continuity equation, Bernoulli's theorem, kinetic energy, correction factor and momentum correction factor in Bernoulli's equation.

Text Books:

1. Bhavikatti S. & Rajashekarappa K.G., "Engineering Mechanics", *New Age International*, New Delhi (1998).
2. Timoshenko SP and Young D H, "Engineering Mechanics", *McGraw Hill (International)*, New Delhi (1984).
3. Kumar D.S., "Fluid Mechanics", *S.K. Katira and Sons*, Delhi (1998).
4. Modi P.N. and Seth S.N., "Fluid Mechanics", *Standard Book House*, New Delhi (1998).

PHY-2217L
Engineering Physics Lab

The student's are required to conduct experiments on following practical work:

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 Gapofa 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 wave length using Fresnsel's biprism/ diffraction grating.
10. To Determine Plank's Constant

CSE-2417L
Computer Programming Lab

List of Experiments:

1. Program on Control Structures and Decision making statements.
2. Program using Loops.
3. Program using Switch case statements with use of break, continue and goto.
4. Programs on array operations.
5. Programs on matrix operations and manipulations.
6. Programs on modular programming and functions.
7. Programs on recursive functions.
8. Programs on structures and unions.
9. Programs on pointers and their manipulations.
10. Programs on files.

ECE- 2317L
Electronics Engineering Lab

List of Experiments:

1. Study of I-V characteristics of PN junction diode.
2. Study of I-V characteristics of Zener Diode.
3. Study of I-V characteristics of a Light emitting Diode.
4. To assemble a half wave rectifier using power diodes and LEDs and study their performance
5. To assemble a center tapped full wave rectifier using power diodes and LEDs and study their performance
6. To assemble a bridge wave rectifier using power diodes and LEDs and study their performance
7. Study of Zener diodes as voltage regulators.
8. Design of an IC based Voltage regulator.
9. Study V-I characteristics of transistor (PNP and NPN). Calculate the performance parameters of transistor.
10. Use NPN transistor as an inverter /switch.

MEE-2617W
Workshop Practice

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.

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., 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.

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.

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.

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, mouldings 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 test, moisture content test, grain fineness test etc.

(b) Practical demonstrations:

Demonstration and practice of mould making with the use of split pattern sand 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.

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.

8. Electrical and electronics section

(a) Theoretical instructions:

Safety precautions, introduction of different types of wiring, circuit breakers, protective relays, power supply, system and its types, various types of circuits, electrification of a workshop, Polarity test, earthing, electrical symbols, soldering technique of a circuit board and soldering joint quality.

(b)Practical demonstrations:

Demonstration and practice of transformer, extension cord, geyser, electrical motor.

Aim: House wiring, stair case wiring for fluorescent tube light, three phase wiring for electrical motors to mass soldering of printed circuit boards as per the instructions.

List of books recommended:-

1. Workshop Technology by Chapman Vol. I, 5th edition, 2013.
2. Workshop Technology by Hajra Chowdhary, Vol. II, 2008.
3. Workshop Technology by Swarn Singh, Vol. I, 2010.
4. Workshop Technology by Virender Narula, Vol. I, 2012.

MEE-3117
Fundamental of Dynamics

UNIT I

Kinematics of Particles: Introduction, rectilinear motion, plane curvilinear motion, rectangular co-ordinates (x-y), normal and tangential co-ordinates (n-t), polar co-ordinates (r-θ), space curvilinear motion, relative motion, constrained particle motion (vectorial approach to be adopted).

UNIT II

Kinetics of Particles: Review of force, mass, acceleration, impulse, momentum, work and energy, linear impulse and linear momentum, angular impulse and angular momentum, impact, central-force and motion, and relative motion, kinetics of systems of particles: introduction, Generalized Newton's second law, work, energy, impulse, momentum, conservation of energy and momentum, steady mass flow, variable mass.

UNIT III

Plane Kinematics of Rigid Bodies: Introduction, rotation, absolute motion, relative velocity, instantaneous center of zero velocity, relative acceleration, Coriolis acceleration motion relative to rotating axes, plane kinetics of rigid bodies: introduction, General equation of Motion, translation, fixed axis rotation, general plane motion, work energy relations, acceleration from work-energy; virtual work, impulse-momentum equation, gyroscopic motion analysis

Text Book:

Meriam, J.L., Kraige, L.G., "Engineering Mechanics: Vol.2, Dynamics". S.I., Version, *John Wiley & Sons Inc.*, 1996.

Reference Book:

Hibbeler, R.C., "Dynamics", *Prentice Hall*, N. Jersey, USA, 2000.

MEE-3217

Mechanics of Materials-I

Mechanics

UNIT I

General concepts: Free body diagram, section forces in beams, general concepts of stress and strain, stresses on inclined plane in an axial member, strain displacement equation, compatibility conditions, statically indeterminate structures, thermal effects. Analysis of stress and strain: Three dimensional states of stress, Mohr's circle, Cauchy's formula, principal stresses and principal planes, three dimensional state of strain, principal strains and principal axes, Generalized Hook's law, elastic constants and their relationships, measurement of strain, strain energy, pressure vessels, stresses and strains in thin cylindrical and spherical shells, thick cylinders, Lame's theory, radial deflection, compound cylinder, effective proportions, laminated cylinders.

UNIT II

Introduction to mechanical properties of solids: Stress – strain diagrams, resilience, hardness, impact strength, symmetric beam bending, the elastic flexural formula and applications, built-up and composite beams, integration method of solution, Macaulay's method of solution, area moment method, statically indeterminate beams, conditions for indeterminacy, energy methods for beams, strain energy and complementary strain energy.

UNIT III

Columns: Concept of elastic stability, Euler's theory of buckling of columns, eccentric loading, short columns,

Torsion: torsion of circular shafts, comparison between hollow & solid shafts, tapered circular shafts, torsion of thin circular tubes, statically indeterminate shafts.

Text Books:

1. Popov, E.P., Balan, T.A, "Mechanics of Solids", *Prentice Hall of India*, New Delhi. 2007.
2. Shames, I.H., Pitaresi, J.M., "Introduction to Solid Mechanics" *Prentice Hall of India*. 2006.
3. Kazmi, S.M.A, "Solid Mechanics", *Tata McGraw Hill, Place, 1998.*

Reference Books:

Fung, Y.C., "Foundations of Solid Mechanics", *Prentice Hall of India*, 1968.

MEE-3317
Fluid Mechanics

UNIT I

Introduction: 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, forces on plane and curved surfaces, buoyancy and the concept of stability of floating and submerged bodies.

UNIT II

Fluid kinematics: 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, continuity equation, momentum equation, energy equation, Euler's equation, Bernoulli equation, ideal fluids, Navier-stokes equations, exact solutions, laminar boundary layer, boundary layer equations, Blausius flow, momentum- integral equation of boundary layer.

UNIT III

Turbulent flow: Laminar-Turbulent Transition, Fluctuations, Turbulent boundary layer equations, Shear stress models, Universal velocity distribution law, pipe flow, friction factor, fully developed pipe flow, pipe bends, pipe losses, dimensional homogeneity, Rayleigh methods, Buckingham's theorem, typical non dimensional parameters, geometric, kinematics and dynamics similarity, model testing.

Text Book:

1. White F.M., "Fluid Mechanics", McGraw Hill, 2001.

Reference Books:

1. Munson, B.R., "Fundamental of Fluid Mechanics", *John Wiley*, 2002.
2. Cengal Y., "Fluid Mechanics", *McGraw Hill*, 2001.
3. Frank M. White, "Fluid Mechanics", *McGraw Hill*, 5th Edition, 2003
4. Robert W. Fox, "Introduction to Fluid Mechanics", *John Wiley*, 7th Edition, 2009

MEE-341
Basic Engineering Thermodynamics

UNIT I

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.

UNIT II

First law for open systems: 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, 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.

UNIT III

Energy: 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, 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, 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.

Text Books:

1. Moran, M.J., Shapiro, "Fundamentals of Engineering Thermodynamics", *John Wiley, 2005.*
2. Wark, K., "Thermodynamics", *Mc-Graw Hill, 2001.*

MEE-3517
Manufacturing Technology - I

UNIT I

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 mounding methods, Casting defects and inspection of castings, automation in foundry.

UNIT II

Machine Tools: Classification of machining processes and machine tools, orthogonal cutting, cutting forces, Ernst 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.

UNIT III

Grinding Methods: 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.

Text Book:

1. Degarmo, E.P., Black, J.T. and Kohser, R.A., "Materials and Processes in Manufacturing", *Prentice Hall of India, Place*, 2005.

Reference Books:

1. Serop, K., Steven, R.S., "Manufacturing Processes for Engineering Materials", *Prentice Hall of India, Place,* 1998.

MEE-3617
Machine Drawing & Computer Modeling

UNIT I

Introduction: Drawing of the following with complete dimensions, tolerances, materials and surface finish marks, assembly drawings from sketches, drawing actual machine components, pipe joints: hydraulic pipe joint, expansion joint (assembly), union joint, symbols for pipe Fittings, keys and types of keys, cotter joints and knuckle joint, pulleys: fast and loose pulley (assembled drawing), V-Belt pulley, Steeped pulley.

UNIT II

Engine parts: Piston, connecting rod, crankshaft and flywheel assembly, cross head, stuffing box, machine parts: Tailstock, Machine Vice and pipe vice, steam stop valve, blow-off cock, screw jack, Process and flow charts.

UNIT III

Introduction to CAD: Theory of general engineering design, conceptual design, embodiment design involving layout and form designing to standard, geometrical modeling, introduction to any 3D-modelling software like AutoCAD, solid works, Autodesk inventor, etc., basic commands and development of 3D Drawings of simple machine parts and assemblies, tail stock, stuffing box, pipe vice, butterfly valve components and their assemblies.

Text Books:

1. Bhat, N.D., "Machine Drawing", *Charotar Publishing House Pvt. Ltd.*, 2008.
2. Gill, P.S., "Machine Drawing", *Kataria and Sons*, New Delhi, 2008.

Reference Book:

Zeid I., "CAD/CAM Theory & Practice", *Tata Mc-Graw Hill*, New Delhi, 2008.

MTH-3717
Mathematics-III

UNIT I

Laplace transforms: 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.

UNIT II

Fourier transform: Fourier Series, Harmonic Analysis, Definition of Fourier Transform, Fourier sine and cosine transform, Fourier integral Formula. Applications to solutions of boundary value problems.

UNIT III

Z-transform: Definition, Linearity property, Z- Transform of elementary functions, Shifting Theorems. Initial and final value Theorem, Convolution theorem, inversion of Z-transforms.

Text Books:

1. Laplace Transforms by Murray R. Speigal, 2008.
2. Advanced Engg. Mathematics: Erwin Kreyzing- *Wiley Eastern. Pub.*, 2009.
2. Higher Engg. Mathematics: B.S. Grewal - *Khanna publishers*, 2012.
3. Advanced Engineering Mathematics: *Michael D Greenberg-PHI*, 2011.
4. Higher engineering mathematics: H. K. Dass, Rajnish Verma-S. Chand, 2014.

MEE-3217L

Mechanics of Materials – I Lab

Experiments to be conducted:

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/wood.
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.

MEE-3317L

Fluid Mechanics-I

Experiments to be conducted

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.

MEE-3517L

Manufacturing Technology –I Lab

Experiments to be conducted

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.

MEE-4117

Material Science

UNIT I

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. 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.

UNIT II

Density computations for metals: 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, 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.

UNIT III

Impurities and their role in materials: grain size determination, diffusion mechanism, steady state diffusion, non steady state diffusion, factors that influence diffusion, diffusion in ionic and polymeric materials, deformation and strengthening mechanisms, plastic deformation of polycrystalline metals, deformation by twining, strengthening by grain size reduction, phase diagrams, solubility limit, phases, micro-structure and phase equilibrium, dielectric materials, Gauss equations, electro-thermo elasticity.

Text Book:

1. Callister, W.D, "Fundamentals of Materials Science and Engineering", *John Wiley & Sons, Inc.* 2001.

Reference Books:

1. Cahn, R.W., Haasen P., "Physical Metallurgy", Vo I, II, III, North-Holland, 1996.
2. Ashby, M., Johonson, K., "Materials and Design" Butterworth-Heinemann, 2002.

MEE-4217
Mechanics of Materials-II

UNIT I

Strain energy due to normal and shear stresses: the total elastic strain of dilation and distortion, the energy elastic theorems, theorems on virtual work, Castigliano's theorem, complementary energy theorems, strain energy due to axial bending and torsional loads, stresses due to suddenly applied loads, use of energy theorems to determine deflection of beams and twists of shafts, Maxwell's theorem of reciprocal deflections and its corollaries, unit couple and unit load methods of determining slopes, deflections, theories of elastic failures, various theories of elastic failure, significance of the theories of failure, comparison and graphical representation, stresses in rotating disc of constant thickness, stresses in hollow & solid discs, stresses in rotating solid and hollow cylinders, stresses in spooked rim.

UNIT II

Overview of I_{xx}, I_{yy}, & I_{xy}: stresses due to unsymmetrical bending, combined bending & axial loads, shear centre for symmetrical and unsymmetrical sections, alternative procedures for calculation of stresses, deflection of straight beams subjected to unsymmetrical bending, bending of beams with large initial curvature, circumferential stresses, location of the neutral axis, application to beams with rectangular, circular and trapezoidal cross sections, stresses in crane hook, stresses in a ring, stresses in a chain link, deflection of curved bars, deflection of curved bars by Castigliano's theorem.

UNIT III

Close coiled helical spring: axial load, axial torque, strain energy in the spring, spring under impact load, springs in series and parallel, concentric springs, open coiled helical spring, axial load, axial torque, stresses in spring wire, combined action of axial load and moment, flat spiral springs, leaf springs, semi-elliptical spring, quarter elliptical leaf spring, graduated & full length leaves, equalized stress in spring leaves, conical springs.

Text Books:

1. Popov, E.P., Balan, T.A, "Mechanics of Solids", *Prentice Hall of India*, New Delhi, 2007.
2. Shames, I.H., Pitaresi, J.M., "Introduction to Solid Mechanics" *Prentice Hall of India, EEE*, New Delhi, 2006.
3. Stephen H. Crandell, Norman C. Dahl, "An Introduction to the mechanics of solids", *McGraw Hill*, 1st Edition, 2012
4. R.C. Hibbeler, "Mechanics of Materials", *Prentice Hall*, 8th Edition, 2010.

Reference Books:

1. Fung, Y.C., "Foundations of Solid Mechanics", *Prentice Hall of India, New Delhi*,1968.

MEE-4317

Theory of Machines-I

UNIT I

Introduction: kinematics and dynamics, lower pairs & higher pairs, degree of freedom (DOF), Grubbler's equation and Kutzbach's criterion, mechanisms and DOF, inversions, Grashoff's law and quick return mechanism, coupler curves, velocity and acceleration analysis, mechanical advantage, transmission and deviation angle, instantaneous centre, friction, types, laws, 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, governors, difference between flywheel and governor, Watt governor, Porter governor, analysis, effect of friction, Proell governor, Hartnell governor, controlling force, sensitivity, stability, hunting, isochronism, effort and power of a governor.

UNIT II

Gears: 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, interference and undercutting, interchangeable gears, 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.

UNIT III

Cams: Comparison with lower paired mechanisms, classification of cams and followers, terminology for cams, types of follower motions, pressure angle, considerations influencing choice of cam, construction of cam profiles, layout, offset followers, precessional motion and angular acceleration, gyroscopic couple, reaction couple, effects on an aeroplane, naval ship, gyroscopic ship stabilization, stability analysis of a two-wheel vehicle, stability of a four-wheel drive on a curved path, acceleration in cartesian and spherical co-ordinates, inertia forces and D'Alembert's principle.

Text Book:

1. Shigley J.E, "Theory of Machines and Mechanisms", Mc Graw Hill, New York,1995.

Reference Book:

1. Mabie H.H., Reinholtz C.F, "Mechanism and Dynamics of Machinery" Fourth edition, *John Wiley & Sons*, 1987.
2. Ambekar A., "Mechanisms and Machine Theory", *Prentice Hall*, New Delhi, 2007.

MEE-4417

Applied Thermodynamics-I

UNIT-I

Carnot cycle for steam: Rankine and modified Rankine cycle, deviation of actual cycles from ideal cycles, cycle efficiency, second law analysis of vapour power cycle, binary vapor power cycles, types of nozzles, isentropic flow through nozzles, effect of friction, nozzle efficiency, critical pressure ratio for maximum discharge, throat and exit areas, supersaturated flow.

UNIT II

Classification of boilers: Water tube, fire tube, boiler mountings and accessories, boiler draught, boiler rating, boiler performance, heat balance, steam turbines, position of steam turbine in power industry, types and applications, impulse turbines, pressure and velocity compounding, velocity diagram, work output, blade, stage, internal and overall efficiency, reaction turbines, velocity diagram, degree of reaction, work out put, losses and efficiency, reheat cycle, regenerative feed heating, direct and indirect feed heating, efficiency and work out put calculations, governing of steam turbines.

UNIT III

Single stage compressor: induction diagram and power requirement, effect of clearance volumetric efficiency, multistage compressors, indicators diagram with and without clearance, effect of intercooling, power requirement, air standard Cycles, Carnot, Otto, Diesel and Dual cycles, work output and efficiency, mean effective pressure, deviation of actual cycles from ideal cycles.

Text Books:

1. Eastop, T.D., "Applied Thermodynamics for Engineering Technologist", *Pearson education*, 1990.
2. Rogers G.F.C., Mayhews, "Engineering Thermodynamics", *Pearson Education*, 1990.

Reference Book:

1. Kearton, W.J., "Steam Turbines", *CBS Publishers*, New Delhi, 1960.

MEE-4517

Manufacturing Technology-II

UNIT I

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, 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.

UNIT II

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, 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.

UNIT III

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), 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).

Text Books:

1. S. K Hajra Choudhury , Elements of workshop technology – Vol. II,, *Media Promoters And Publishers*, Mumbai,2014.
2. Amitabh Ghosh and Asok kumar Mallik, Manufacturing science, *Ellis* Horwood Ltd, 2012.
3. Mikell. P. Grover, Fundamentals of Modern Manufacturing, *Pearson Publications*, 2004.
4. P. C. Sharma, Production Engineering, *S. Chand Publication*, 2008.

Reference Book:

1. Serop K. Steven, "Manufacturing Processes for Engineering Materials", *Prentice Hall of India*, New Delhi, 2004.

ELE-4617

Electrical Engineering

UNIT I

Network analysis and theorems: basic circuit theory (D.C and A.C), resistance, inductance and capacitance, Ohm's law, KCL, KVL , power and energy relations, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, sinusoidally excited circuits, basic definitions of A.C. circuits, phasor algebra and complex number representations, solutions of sinusoidally excited R.L.C circuits, Introduction to 3-phase circuits.

UNIT II

Transformers: Construction, principle of operation, e.m.f. equation, phasor diagrams, no load and on load, equivalent circuit model, voltage regulation and test, introduction to 3- phase transformers, applications, D.C. generators and motors, basic construction, principles of operation, types of D.C. generators and motors, applications.

UNIT III

Transducers: Definitions, types of transducers and their applications for mechanical measurements, ammeters and voltmeters, meter range extension and their connections in their circuits, bridge methods to measure, resistance, inductance and capacitance, various types of bridges and their applications for measuring, R, L and C, measurement of power and energy, Wattmeters, measurement of power using watt meters, energy meters and measurement of electrical using energy meters, digital instruments, introduction to digital meters for the measurement of various electrical quantities.

Text Book:

1. Nagrath, I.J., Kothari, D. P., "Electrical Machines," *Tata Mc Graw Hill*, New Delhi, 1985.

Reference Books:

1. Del Toro, V., "Principles of Electrical Engineering," *Prentice Hall International*, 1985.

MEE-4317L

Theory of Machines-I Lab

Experiments to be conducted

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.

MEE-4417L

Applied Thermodynamics-I

Experiments to be conducted

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.

MEE-4517L

Manufacturing Technology –II Lab

Experiments to be conducted

A) Jobs on CNC lathe machine.

Safety precautions and study of CNC lathe machine.

(i) Performing step turning.

(ii) Performing taper turning.

(iii) Performing radius turning.

(iv) Performing multiple turning cycles.

(v) Performing pattern repetition cycle operation.

B) Jobs on CNC milling machine.

Study of CNC milling machine.

(i) Performing linear cuts and circular cuts.

(ii) Performing linear and circular cuts using subroutines.

(iii) Performing pocket milling.

C) Metrology

(i) Use of sine bars and slips gauges for angle measurement.

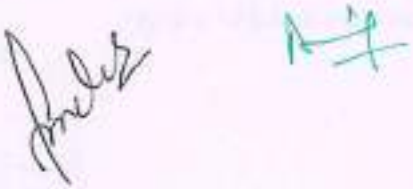
(ii) Use of bevel protector and dial gauges.

MEE-4617L

Electrical Engineering-II Lab

Experiments to be conducted

1. To study the overall safety procedures to be employed, while working with electric circuits.
2. To study the series and parallel operations of resistors, inductors and capacitors.
3. To verify
   - KVL and KCL in DC circuits.
   - Superposition theorem.
   - Thevenin's Theorem.
4. To measure electric power in a single phase AC circuit with resistive load, R – L and RLC load.
5. To study the overall construction of electric machines.
6. Measurement of electric energy by
   - KWH meter.
   - Watt meter.
7. Measurement of power factory by
   - Power factor meter.
   - Voltmeter, Ammeter and Watt meter method.



MEE-5117

Theory of Machines-II

UNIT I

Harmonic motion: periodic motion, vibration terminology, complex method of representing harmonic vibration, Fourier series and harmonic analysis, mathematical modeling for vibrations springs in series and parallel, differential equation of motion, solution of differential equation, torsional vibrations, various types of damping, dry friction and coulomb damping, structural damping, free vibration with and without viscous damping, logarithmic decrement, energy methods.

UNIT II

Forced harmonic vibration: rotating unbalance, support motion, vibration isolation, energy dissipated by damping, equivalent viscous damping, structural damping, vibration measuring instruments, impulse excitation, arbitrary excitation, Laplace transform formulation, pulse excitation and rise time, shock response spectrum, shock isolation.

UNIT III

Normal mode analysis: initial conditions, coordinate coupling, forced harmonic vibration, vibration absorbers and vibration dampers, generalized coordinates, natural frequencies and mode shapes (Eigen values and Eigen vectors), modal analysis, continuous systems, critical speed of a light shaft without damping, and with damping, critical speed of shaft having multiple discs, secondary critical speed, critical speed of a light cantilever shaft, balancing of engines.

Text Book:

1. Grover, G. K. "Mechanical Vibrations, 7th edition, Nem Chand and Bros, New Delhi, India 1996.

Reference Books:

1. Meirovitch, "Elements of vibration analysis," *2nd edition, McGraw Hill,* 1998.
2. Thomson, W. T., "Theory of Vibrations with applications" *5th edition, Pearson Education, 2004.*

MEE- 5217

Machine Design-I

UNIT I

Introduction: Design considerations, codes and standards, various types of loading in mechanical systems, stress concentration, S-N diagram, low cycle fatigue, high cycle fatigue, endurance limit, endurance limit modifying factors, size effect, surface effect, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage, modified Goodman diagrams, Gerber equation.

UNIT II

Shafts, keys and couplings: Torsion of shafts, design for strength and rigidity with steady loading, ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads, keys, types of keys, design of keys and design of splines, couplings, rigid and flexible couplings, flange coupling, bush and pin type coupling.

UNIT III

Riveted joints: Types, failures of riveted joints, joint efficiency, boiler joints, tank and structural joints, riveted brackets, welded joints: Types, strength of butt and fillet welds, eccentrically loaded welded joints, power screws: Mechanics of power screw, stresses in power screws, efficiency and self- locking, design of power screw, design of Screw Jack, cotter and knuckle joints: Design of cotter and knuckle joints

Text Books:

1. Ullman D.G., "The Mechanical Design process", *3rd edition, McGraw Hill*, 2009.
2. Mott, R.L, "Machine Elements in Mechanical Design", *4th edition, Prentice Hall*, Singapore, 2005.
3. Shigley, J.E., Mischke, C. Brown T., "Standard Hand book of Machine Design" *McGraw Hill.*

Reference Books:

1. Shigley, J.E., "Hand Book of Machine Design", *McGraw Hill,* 2004.

MTH-5317

Mathematics-IV

UNIT I

Special functions: Solution of series, Legendres functions, Rodriguess formula, generating functions for Legendres, polynomials and recurrence formulae, Bessel's functions, recurrence formulae and Bessel's functions of integral order.

UNIT II

Numerical solution of partial differential equation's: Finite difference approximation of partial derivatives, solution of Laplace equations, solution of one dimensional heat flow equation by Crank Nicolson method.

UNIT III

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, 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.

Text Books:-

1. B.S.Grewal, "Higher Engineering Mathematics" 2008.
2. H.K Das, "Advanced Engineering, Mathematics" 2012.

ECE-5417

Industrial Electronics

UNIT I

Introduction to semi-conductors: Intrinsic & extrinsic semiconductors, transport mechanism of charge carriers, electrical properties, P-N Junction diode, characteristic of diode capacitances, application of diode, diode as a switch, different types of diode and their applications.

UNIT II

BJT's: Types, operations and characteristics, CE, CB, CC configurations, transistor circuits, transistor as an amplifier, transistor as a switch, operational amplifier basis, OP-amp as ineverting and non-inverting amplifier and its applications.

UNIT III

Oscillators: Barkhausan's C and different types of oscillators, modulation, amplitude modulation, frequency modulation, types of modulators, power electronics circuits, SCR, diac, triac, regulated power supplies, electronic welding.

Text Book:

1. Millman, J., Halkias, Ch.C., "Basic Electronics", *Tata McGraw Hill*, New Delhi, 1998.

MEE-5517

Heat Transfer

UNIT I

Introduction: Modes of heat transfer, Fourier's law of heat conduction, thermal conductivity of solids, liquids and gases, combined heat transfer problems, one dimensional steady heat conduction, thermal resistance, thermal diffusivity, general three dimensional heat conduction equation in cartesian, cylindrical and spherical coordinates, heat conduction with heat generation, fins, two dimensional steady state heat conduction through plane wall, unsteady heat conduction with negligible internal temperature gradients, spheres, cylinders and cubes heat conduction when internal temperature gradients are not negligible, sphere, long cylinder and large slab, heat flow in semi infinite solids, with periodic change in surface temperature.

UNIT II

Fundamentals of convection: Mechanism of natural and forced convection, local and average heat transfer coefficient, concept of velocity & thermal boundary layers, forced convection: Dimensionless numbers and their physical significance, empirical correlations for external & internal flow for both laminar and turbulent flows, natural convection: Introduction, dimensionless numbers and their physical significance, empirical correlations for natural convection.

UNIT III

Radiation: Thermal radiation, black and gray surfaces, radiation laws, heat transfer by radiation between black and gray surface shape factors, heat transfer by radiation between two surfaces, heat transfer in presence of reradiating surfaces, radiation shields, heat exchangers: Classification and applications, heat exchanger analysis – LMTD for parallel and counter flow heat exchanger, effectiveness– NTU method for parallel and counter flow heat exchanger, introduction to cross flow heat exchanger, LMTD correction factor, design criteria for heat exchanger, introduction to heat pipe.

Text Books:

1. Incropera, F.P., "Fundamentals of Heat and Mass Transfer ", *John Wiley*, 2005.
2. Kreith F., Bohn, "Principles of Heat Transfer", *Cengage publishers*, 2006.
3. Holman, J.P., "Heat Transfer", *McGraw Hill*,2009.

Reference Book:

1. Bejan, A., "Heat Transfer", *John Wiley*, 1998.

MEE-5617

Industrial Engineering-I

UNIT I

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.

UNIT II

Introduction to method study and the selection of jobs: Record, examine and develop, objectives and basic procedure of method study, recording techniques (process charts (PC), and diagrams),outline PC, Flow process charts, two hand process charts, MAC, simo chart, flow diagram, string diagram, cycle graph, chronocycle graph, travel chart, define, install and maintain, the principles of motion economy.

UNIT III

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.

Text Book:

1. Barnes, R.L., "Motion and Time Study, Design & Measurement of Work" *7th edition, John Wiley & Sons*, New York, 1980.

Reference Books:

1. International Labor Office, Geneva, "Introduction to Work Study" *4th Edition*, Geneva, 1985.
2. Currie R.M, "Work study", *ELBS & Pitman*, London, 1977.
3. Mundel, M.E., "Motion and Time Study", *5th Edition, Prentice Hall*, Englewood Cliff, New York, 1978.

MEE-5117L

Theory of Machines-II Lab

Experiments to be conducted

1. Determine the time period of a simple pendulum. Verify that the time period is independent of the mass of the bob.
2. Determine the radius of gyration of a compound pendulum.
3. Determine the radius of gyration of a given bar by using a Bifilar suspension.
4. Study the undamped free vibration of an equivalent spring mass system.
5. Study the forced vibration of an equivalent spring mass system.
6. Study the torsional vibration of a single rotor shaft system.
7. Determine the frequency response function of an equivalent spring- mass- dashpot system.
8. Pressure profile measurement on journal bearing.

MEE- 5417L

Industrial Electronics Lab

Experiments to be conducted

1. Study of CRO measurement of voltage, frequency and phase of a give n waveform.
2. To obtain diode characteristics.
3. a) To assemble a half wave and a full wave rectifier and to study their performance. b) To suppress the ripple using RC filter.
4. To obtain Zener diode characteristics and to use Zener diode as a voltage regulator.
5. To assemble and observe the performance of clipping and clamping circuits.
6. To obtain transistor characteristics in the following configurations: i) Common base. ii) Common emitter.
7. To assemble a CE amplifier and observe the performance.
8. To assemble a differential amplifier and obtain in CMRR circuits .
9. To study different application of OP AMPS.
   - OP – AMP as an inverting amplifier.
   - OP – AMP as a Non inverting amplifier.
   - OP – AMP as an integrator.
   - OPAMP as a differentiator.
10. To study the performance of a voltage regulator IC chip.

MEE-5517L

Heat Transfer Lab

Experiments to be conducted

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.

MEE-5617L

Industrial Engineering –I Lab

Experiments to be conducted

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.

MEE-6117

Measurement and Instrumentation

UNIT I

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, relative and absolute motion devices, relative displacement, resistive potentiometers, bridge circuit, LVDT, Variable inductance and variable capacitance pick-ups, piezoelectric transducers, fiber 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.

UNIT II

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, 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.

UNIT III

Orifice meters: venturimeter, pitot tube, flow nozzle, variable area meters, rotameter, design and accuracy, 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.

Text Book:

1. Beckwith, B., "Mechanical Measurements", *6th edition, Pearson Education Int.*, 2008.

Reference Book:

1. Nakra B.C. "Instrumentation, Measurements & Analysis", *2nd edition, Tata McGraw Hill*, N.Delhi, 2008.
2. Doeblin, E.O., "Measurement systems", *5th edition, McGraw Hill*, New Delhi, 2004.

MEE-6217

Machine Design-II

UNIT-I

Design of friction elements: Various types of brakes, design equations for various types of brakes, design analysis of all types of brakes, e.g., band brake, long shoe brake, etc, design analysis of all types of clutches, design of shafts, etc, design and analysis of flat and V-belt, equations for power, slip, etc, design of chain drive.

UNIT II

Introduction to gear design: Design of spur gear, equation for σ_b and σ_c for spur gear, design analysis for bending, force analysis for helical gear, design analysis for helical gear, design of bevel gear, determination of bearing forces, horizontal and vertical shafts, design analysis for bevel gear , design analysis for worm gear.

UNIT III

Introduction to plain bearings: Design of hydrodynamic bearings, derivation of Reynolds equation for three dimensional case, journal bearing geometry, variation of viscosity with pressure and temperature, viscosity index, Sommerfeld number, analysis of h_o, h_{min}, Q_{in}, Q_{loss}, T_{in} , T_{out}, introduction to rolling element bearings, design of AFB, equations for L_{10} life, static loading and dynamic loading , use of AFB catalogue, determination of load based on radial and thrust load for ball bearings.

Text Books:

1. Mot, R.L., "Machine Elements in Mechanical Design", *Maxwell Macmillan Intl. edition* N.York, USA, 1992. Shigley, J.E.,
2. "Machine Engineering Design", *McGraw Hill. higher education*,2004.

Reference Books:

1. Shigley, J.E., Mischke, C. Brown T., "Standard Hand book of Machine Design" *McGraw Hill.*

MEE-6317

Fundaments of Tribology

UNIT I

Introduction to tribology: Tribology in Industry, energy saving through tribology, engineering surfaces and interaction between surface, production of engineering surface, surface roughness, rms value, average value and ten point average of surface roughness, development of engineering surface and measurement of surface roughness, tribology in industry, losses due to friction and wear in industry, tribo-elements and a systems concept in tribology, introduction to friction static and dynamic friction analysis, DaVinci concept of friction, Amonton's laws of friction, Coulomb's laws of friction, Bowden and Tabor concept of friction.

UNIT II

Wear and types of wear: Adhesive wear and its mathematical model, two body abrasive wear, three body abrasive wear, abrasive wear and its mathematical model, corrosive wear model, erosive wear model, cavitation wear, scuffing wear, delimination wear, pitting wear, wear coefficient and wear measurement, wear measurement through pin-on-disc machine, pin-on-ring, profilometer, wear coefficient of various materials.

UNIT III

Lubricants: Types of lubricants, physical adsorption, chemisorption, self lubrication properties of materials, solid lubrication, lubrication in space, food industry, etc, high temperature lubrication, hydrodynamic lubrication, various components of Reynolds equation, Sommerfeld number and its use in hydrodynamic lubrication, materials for tribological applications.

Text Books:

1. Czichos, H., "A system approach to science and Technology of Friction, Lubrication and Wear" Volume I, Tribology series, Elsevier Publications, 1978.
2. Glaeser, J " Materials for Tribology", Tribology series Vol. 20, Elsevier Publications, 1992.

Reference Books:

1. Peterson M.B.,Winner W.O, "Wear control Handbook" sponsored by *The Research Committee on Lubrication, Publsher*, , 1980.
2. Cameron A., "The principles of Lubrication", *Longman*, London, 2000

MEE-6417

Linear Optimization in Engineering

UNIT I

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, duality and sensitivity analysis, transportation model problems and their variants, assignment model problems.

UNIT II

Project planning and scheduling: CPM & PERT, Project crashing and recourse allocation problems, decision theory, steps in decision making, decision making under uncertainty and under risk, marginal analysis, decision trees.

UNIT III

Flow shop scheduling: Job shop scheduling, queuing theory and their applications, waiting line models and their applications, introduction and basic concepts of simulation.

Text Book:

1. Taha, H.A., "Operation Research- an Introduction", *6th edition, Prentice Hall of India*, New Delhi, 2000.

Reference Books:

1. Joseph Ecker, Michael K, "Introduction to Operations Research" *John Wiley & Son*, 1998.
2. Hillier &Lieberman, "Introduction to Operations Research", *Mc-Graw Hill*, Singapore, 2001.
3. Gupta M.P, Khanna R.B., "Quantitative Techniques for Decision Making", *Prentice Hall of India*, New Delhi, 2008.

MEE-6517

Introduction to Mechatronics

UNIT I

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 modeling, electromechanical systems structures and materials, modeling of mechanical systems for mechatronics applications.

UNIT II

Sensors and actuators: 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.

UNIT III

Role of controls in mechatronics: Role of modeling in mechatronics design, response of dynamic systems, introduction to computer and logic systems, 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.

Text Book:

1. Shetty D., Richard A.K., "Mechatronics system design", *Cengage learning*, 2011.

Reference Books:

1. Dan S.N., "Mechatronics" *Prentice Hall*, 2002. 2. "Micromechatronics

MEE- 6617L

Fundaments of Tribology Lab

Experiments to be conducted

Preparation of samples for friction and wear tests.

- Polishing
- Cleaning.

1. Microhardness measurement; Knoop and Vicker for metals, polymers and ceramics
   - HV V/s load plots.
   - HK V/s load Plots.
   - Influence of indentation time.
   - HV V/s indentation time
   - HK V/s indentation time
2. Measurement of friction
3. Measurement of wear through weight loss, etc.
4. Plot of friction coefficient v/s load , and plot of wear volume v/s load
5. Calculation of wear coefficient for a metallic material.
6. Calculation of wear coefficient for ceramics.
7. Measurement of friction in presence of lubricant at room temperature.
8. Measurement of wear under lubricated conditions for metallic materials.
9. Influence of additives on friction and wear of metals.

MEE-6717L

Mechatronics Lab

Experiments to be conducted

1. Sensor/actuator - interfacing, calibration, frequency domain characterization, MATLAB serial interface, and serial LCD display
2. Design of electro-pneumatic circuits for L and square cycles using PLC's.
3. Sorting of components on an intelligent a conveyor system.
4. Modeling of DC motor System.
5. DC motor position tracking.
6. DC motor position set-point control via PID controller, using relay automatic tuning technique.
7. Dissection of an existing system.
8. Demonstration of recent projects on mechatronics.

MEE-7117

Hydraulic Machinery

UNIT I

Force due to a jet on a curved plate, velocity diagram for axial and radial flow turbine blades, work output and efficiency, pelton turbine, main components nozzle and jet diameters, mean diameter of pelton runner, jet ratio, minimum number of buckets, work done, power developed and turbine efficiencies, governing of impulse turbines.

UNIT II

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.

UNIT III

Rotodynamic pumps, classification, centrifugal pumps, specific speed, velocity diagrams, heads, power and efficiency, special features of propeller and mixed flow pumps, positive displacement pumps, reciprocating pump, indicator diagram, effect of friction and acceleration, theory of air vessel, selection of water turbines, hydro-electric power plants, hydraulic coupling, torque converter and dynamometer, hydraulic power transmission.

Text Book:

1. Massey, B.S., "Mechanics of Fluid", *6th Edition, Van Nostrand Reinhold co.*, 1968.
2. Jagdish, L., "Hydraulic Machines including Fluidics", *Metropolitan Books co. Pvt. Ltd.*, 1997

Reference Books:

1. Guthrie, Brown, "Hydroelectric Engineering Practice, *CBS Publishers*, New Delhi, 1993.
2. Douglas, Gasiorek, Swaffield, "Fluid Mechanics", *Pearson Education*, 2007.

MEE-7217

Automatic Control

UNIT I

Introduction: Concept of automatic control, open loop and closed loop systems, servomechanism, block diagram, transfer function, representation of control components and systems, translation and rotational mechanical components, electrical components series and parallel combinations, comparators for rotational and linear motions, integrating devices, hydraulic servomotor, temperature control systems, speed control systems.

UNIT II

System response: First and second order systems, response to step, pulse, ramp and sinusoidal inputs, systems with distance velocity lag, modes of controls, proportional control, proportional pulse reset control, proportional pulse rate control, proportional reset rate control, two position control, controller mechanism: pneumatic, hydraulic and electric controllers, general principles and circuits for generating various control actions.

UNIT III

Control system analysis: Transient response of simple control systems, stability of control systems, Routh's criterion, frequency response analysis, polar, rectangular and logarithmic plots, experimental determination of frequency response, Bode and Nyquist stability criteria, gain and phase margins, root locus plots of simple transfer function, transient response from root locus, electronic analogue computers: elements of analogue computers, solution of simple differential equations.

Text Books:

1. Ogata, K., "Modern Control Engineering", *Prentice Hall of India, 3rd edition*, New Delhi,1997

Reference Books:

1. Raven, F., "Automatic Control," *McGraw Hill Int.*, 1999

MEE-7317

Industrial Engineering-II

UNIT I

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: 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, 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.

UNIT II

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.

UNIT III

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.

Text Book:

1. Everett, E.A., Ronald J.E, "Production and Operations Management" Prentice Hall of India, 5th edition, New Delhi, 2001.

Reference Books:

1. Claude, S.G., "Management for Business & Industry" *Prentice Hall of India*, New Delhi, 2000.

2. Everett, E.A., Ronald J.E, "Production and Operations Management", *Prentice Hall of India*, 5th Edition, New Delhi, 2001.
3. Grant, E.L; Leavenworth R.S, "Statistical Quality Control", *Tata McGraw Hill*, 7th Edition, New Delhi, 1996.
4. Apple, J.M, "Plant Layout & Material Handling", *John Wiley & Sons*, New York, Maynard, 1996.

MEE-7417

Applied Thermodynamics-II

UNIT I

Gas dynamics: Definitions and basic relations, energy equation, rate equations for a control volume, iso-entropic flow with variable area, wave motion, flow with normal shock waves, flow in constant area ducts with friction, flow in constant area ducts with heat transfer, centrifugal compressor, energy transfer in compressors and turbines, Euler's equation, principles parts and description of centrifugal compressor, impeller diameter, number of blades, velocity diagram, slip, factor work input, factor pressure coefficient, compressor efficiency.

UNIT II

Axial flow compressor: Stage velocity diagram, stage pressure ratio and number of stages, degree of reaction blade and stage efficiency, polytropic and isentropic efficiency surging, gas turbines, ideal gas turbine cycle, condition for maximum output, actual gas turbine cycles, reheating and regeneration velocity diagram for a stage, stage pressure ratio and number of staged polytropic efficiency, isoentropic efficiency, jet propulsion, turbojet cycle, net thrust, specific thrust, thermal efficiency of turbojet engine, propulsive efficiency, effect of forward speed.

UNIT III

Applications of refrigeration and air-conditioning: thermal principles for refrigeration, vapor compression system, reversed Carnot cycle, survey of refrigerants, designation of refrigerants, selection of refrigerants, thermodynamic requirements, multistage compression, multi-evaporator system, cascade systems, systems practices for multistage systems, reciprocating compressors, rotary screw compressors, vane compressors, centrifugal compressors, condensers, heat transfer in condensers, evaporators, heat transfer in evaporators, extended surface evaporator, cooling and dehumidifying coils, automatic or constant-pressure expansion valve, psychometric properties, wet bulb temperature, psychometric chart, mixing process.

Text Book:

1. Cohen H, Rogers G.F.C., "Gas turbine Theory", *Pearson Education*, , 2001.
2. Yahya, S.M., "Fundamentals of Compressible flow", *New Age India*, Place, 2002.
3. Arora C.P., "Refrigeration and Air conditioning", *McGraw Hill*, New Delhi, 1990.

Reference Books:

1. Stoeker, W.F., "Refrigeration and Air conditioning", *McGraw Hill*, 1990.
2. Shapiro A.H., "The Dynamics and Thermodynamics of Compressible Fluid Flow", *Ronald Press*, 1953.

MEE-7517

Computer Applications in Mechanical Engineering

UNIT I

Overview of C++: flow charts, computer languages, constants and variables, arithmetic expressions, input/ output, control and the do and for statements, introduction to programming. types of errors, computational algorithms and computer arithmetic, iterative methods, solution of equations, bisection method, Regula-falsi method, Newton Raphson method, solution of linear system of equations: Gauss elimination, Gauss-Jordan, Gauss-Siedel method, LU decomposition.

UNIT II

Interpolation and approximation of functions: Newtons forward formula (equal and unequal intervals) curve fitting (straight line, nonlinear, exponential) differentiation, integration (Simpson's rule, Weddle's) and program.

UNIT III

Numerical solution of ordinary different equations: Runge-Kutta methods, types of PDEs, boundary value problems, solution of parabolic PDEs using finite differences and program, examples to be taken from mechanical engineering applications.

Text Book:

1. Sastry,S. " Numerical Methods", *Prentice Hall of India*, New Delhi.

Reference Books:

1. Lafore , G, "C++ Programming", *Galgotia publishers*, New Delhi, 2001.
2. Veerarajan, " Numerical Methods", *Tata Mc-Graw Hill*, New Delhi, 2000.

MEE- 7317L

Industrial Engineering –II Lab

Experiments to be conducted

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 SDs 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.

MEE- 7517L

CAME Lab

Experiments to be conducted

Develop programme and algorithm for:

1. Bisection method.
2. Regula - Falsi method.
3. Newton Raphson method.
4. Gauss Elimination method.
5. Gauss Jordon method.
6. Gauss Seidel method.
7. Integration by trapezoidal method.
8. Integration by Simpson rule (1/3 and 3/8).
9. Solution of ordinary differential equations and Partial differential equations by

a) R.K methods.

b) Solution of Parabolic partial differential equation.

MEE-8117

Production and Operations Management

UNIT I

Managing and planning operations: Introduction to operations management (OM), historical perspective and growth, operations strategies for competitive advantage, forecasting (FC), nature and use of FC, sources of data, demand pattern, FC models, designing products, services and processes, new product design, product development, product life cycle, product development process, product reliability, process technology life cycle, flexible manufacturing systems.

UNIT II

Scheduling systems and aggregate planning for products and services: operations planning and scheduling systems, the aggregate planning process, strategies for developing aggregate planning, master schedule and rough cut capacity planning, implementing aggregate plans and master schedules, material requirement planning (MRP).

UNIT III

Managing for world class competition Japanese contribution for WCM: JIT manufacturing, basic concepts of TQM, ISO, Poka-Yoke and Kaizen, business process re-engineering, lean manufacturing, concepts of supply chain management.

Text Book:

1. Panneerselvam R, " Production and Operations Management", *2nd Edition*, 2005

Reference Books:

1. Roberta S. Russell, Taylor B.W, "Operations Management", *Pearson Prentice Hall, 4th edition*., 2001.
2. Everett, E.A., Ronald J.E, "Production and Operations Management" *Prentice Hall of India, 5th edition*, New Delhi, 2001
3. Evans J.R., Collier D.A., "Operations Management, An Integrated Goods and Services Approach", *Cengage Learning India*, New Delhi, 2007.

MEE-8217

Internal Combustion Engines

UNIT I

Thermodynamics of actual working fluids: working fluid before combustion, valve and port timing diagrams, thermodynamic properties of fuel-air mixture before combustion, use of combustion charts for unburned mixture, use of combustion charts for burned mixture appropriate treatment of fuel air mixtures, fuel air cycles: definition, constants, volume fuel air cycle, limited pressure cycle, characteristics of fuel-air cycles, comparison of real and fuel cycles, air capacity of four stroke engines: ideal air capacity , volumetric efficiency , ideal induction process, actual induction process, effect of operating conditions on volumetric efficiency, effect of design on volumetric efficiency, estimating air capacity.

UNIT II

Two stroke engines: scavenging process, ideal scavenging process, relationship of scavenging ratio and scavenging efficiency, power to scavenger, supercharged two stroke engines, combustion and detonation: chemistry of combustion, normal combustion in S.I engines , pre-ignition and auto-ignition comparison, detonation in S.I engines, combustion in C.I engines, detonation in C.I engines, methods of reducing detonation , preliminary detonation, preliminary facts about fuel and dopes, octane and cetane numbers, effect of design on detonation, mixture requirements, steady running, mixture requirements, transient mixture requirements, mixtures requirements for fuel injection engines, mixture requirements for S.I engines, performance of supercharged engines: engine performance measures, commercial engine ratings, basic performance equations for un-supercharged engines, effect of atmospheric conditions, altitude and compression ratio on performance characteristics, performance curves, supercharged engines: definitions, reasons for supercharging, supercharging of S.I engines, supercharging of diesel engines.

UNIT III

Heat losses and cooling: Area of heat flow engines, temperature profile, engine cooling system, numericals on heat transfer in IC engines, Engine design: selection of type, engine speed and principles of similitude, numerical on alternative fuels, numerical on diesel fuel injection system, numericals on engine specification and verification, numerical on two stroke engines, general design of petrol and diesel engine, numericals on engine design, determination of main dimensions, comparative numerical on two stroke engines and four stroke engines.

Text Book:

1. Heywood, J.B., "Internal Combustion Engine fundamentals", *Mc-Graw Hill Book Co.*, USA, 1989.

Reference Books:

1. Domkundvar V.M., "A course in internal combustion engines", *Dhanpat Rai and company*, New Delhi, 1999.

MEE-8317

Theory of Elasticity

UNIT I

Introduction: Elasticity, stress components of stress and strain, Hooks law, equations in polar coordinates, plane stress and plane strain, strain at a point, Mohr circle for strain rosette, differential equation of equilibrium, boundary conditions, compatibility equations, overview of Airys stress functions.

UNIT II

Two dimensional problems in rectangular coordinates: solution by polynomials, St. Venants principles, determination of displacement, bending of beams, solution by Fourier series, Two dimensional problems in polar coordinates: equations in polar coordinates, equation about 1-axis, and pure bending in curved bars.

UNIT III

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: stress at a point, principal stress, stress ellipsoid and stress director surface, homogenous deformation, strain at a point, principle strain rotation.

Text Books:

1. Timoshenko, S.P. and Goodier, J.N., "Theory of Elasticity," *Mc-Graw Hill Book Company*, N.Y., USA, 1970.

Reference Books:

1. Love, A.E.H., "The Mathematical Theory of Elasticity," *Dover Publications*, NewYork, USA, 1944.

MEE-8417

Power Plant Engineering

UNIT I

Introduction: 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: 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: 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.

UNIT II

Nuclear Power Plants: Nuclear fuel, nuclear energy by fission, main components of nuclear reactors, pressurized water, boiling water, liquid metal and gas nuclear reactors, 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.

UNIT III

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, combined operation of different power plants: Advantages of combined working, load division among power stations, storage.

Text Book:

1. Rajput R.K., "A text book of power plant engineering", *Laxmi Publication, Pvt. Ltd.*, New Delhi, 2007.

Reference Books:

1. Domkundwar, S., "Power Plant Engineering", *S.C. Chand and company*, New Delhi, 2000.
2. Joel W, Roy E, "Modern Power Plant Engineering", *Prentice-Hall of India Ltd.*, New Delhi, 1985.

MEE-8517

Fracture Mechanics

UNIT I

Summary of basic problems and concepts in fracture: A crack in a structure, crack tip stresses, The Griffith criterion, crack opening displacement criterion, crack propagation, mechanisms of fracture and crack growth, cleavage fracture, ductile fracture, fatigue cracking, environmental assisted cracking, service failure analysis.

UNIT II

The elastic crack-tip stress field: Airy stress function, complex stress function, solution to crack problems, the effect of finite size, some special cases, elliptic cracks, the energy principles, the concept of energy release rate, the criterion for crack growth, the crack resistance, the concept of J-integral.

UNIT III

Crack-tip plastic zone: Irwin's plastic zone correction, the Dug-dale approach, plane stress versus plane strain, plastic constraint factor, the thickness effect, application of Von Mises and Tresca yield criteria to obtain plasticity effected regions, dynamics and crack arrest, crack speed and kinetic energy, the dynamic stress intensity and elastic energy release rate, principles of crack arrest.

Text Book:

1. Anderson T.L., "Fracture Mechanics Fundamentals and applications", *CRC, Taylor & Francis*, 2005

Reference Book:

1. Janssen M.J., Zuidema, J., Wanhill R.J.H., "Fracture Mechanics", *Spon Press*, 2004.

MEE-8217L

I.C Engines Lab

Experiments to be conducted

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.