B. TECH. (MECHANICAL ENIGINEERING)

SEMESTER I

COURSE NO.	COURSE NAME	L	T	P	C
CH101	CHEMISTRY	3	1	0	8
EE101	ELECTRICAL SCIENCES	3	1	0	8
MA101	MATHEMATICS - I	3	1	0	8
PH101	PHYSICS - I	2	1	0	6
CH110	CHEMISTRY LABORATORY	0	0	3	3
ME110/PH110	WORKSHOP/ PHYSICS LABORATORY	0	0	3	3
ME111***	ENGINEERING DRAWING	1	0	3	5
SA101	PHYSICAL TRAINING - I	0	0	2	0
	[NCC/NSO/NSS]	0	0	2	0
		12	**4**	**9**	**41**
****FOR 2010 BATCH, CREDIT STRUCTURE FOR ME111 IS 0-0-3-3**					

SEMESTER II

COURSE NO.	COURSE NAME	L	T	P	C
BT101	MODERN BIOLOGY	3	0	0	6
CS101	INTRODUCTION TO COMPUTING	3	0	0	6
MA102	MATHEMATICS – II	3	1	0	8
ME101	ENIGINEERING MECHANICS	3	1	0	8
PH102	PHYSICS – II	2	1	0	6
CS110	COMPUTING LABORATORY	0	0	3	3
EE102	BASIC ELECTRONICS LABORATORY	0	0	3	3
PH110/ME110	PHYSICS LABORATORY/ WORKSHOP	0	0	3	3
SA102	PHYSICAL TRAINING – II	0	0	2	0
	NCC/NSO/NSS	0	0	2	0
		14	**3**	**9**	**43**

SEMESTER III

COURSE NO.	COURSE NAME	L	T	P	C
MA201	MATHEMATICS – III	3	1	0	8
ME211	THERMODYNAMICS	2	1	0	6
ME212	SOLID MECHANICS – I	2	1	0	6
ME213	ENGINEERING MATERIALS	3	1	0	8
HS2xx	HSS ELECTIVE – I	3	0	0	6
ME214	MACHINE DRAWING	0	0	4	4
SA201	PHYSICAL TRAINING -III	0	0	2	0
	NCC/NSO/NSS	0	0	2	0
		13	**4**	**4**	**38**

SEMESTER IV

COURSE NO.	COURSE NAME	L	T	P	C
ME221	FLUID MECHANICS – I	2	1	0	6
ME222	MANUFACTURING TECHNOLOGY – I	3	0	0	6
ME223	SOLID MECHANICS -II	3	0	0	6
ME224	KINEMATICS OF MACHINERY	2	1	0	6
HS2xx	HSS ELECTIVE – II	3	0	0	6
ME225	WORKSHOP – II	0	0	6	6
ME226	MECHANICAL LAB – I	0	0	3	3
SA202	PHYSICAL TRAINING – IV	0	0	2	0
	NCC/NSO/NSS	0	0	2	0
		13	**2**	**9**	**39**

SEMESTER V

COURSE NO.	COURSE NAME	L	T	P	C
ME311	FLUID MECHANICS – II	3	0	0	6
ME312	MANUFACTURING TECHNOLOGY – II	3	0	0	6
ME313	DYNAMICS OF MACHINERY	2	1	0	6
ME314	DESIGN OF MACHINE ELEMENTS	3	0	0	6
EE380	ELECTRICAL MACHINES	3	0	0	6
HS3xx	HSS ELECTIVE - III	3	0	0	6
ME315	MECHANICAL LAB - II	0	0	3	3
		17	**1**	**3**	**39**

SEMESTER VI

COURSE NO.	COURSE NAME	L	T	P	C
ME321	APPLIED THERMODYNAMICS - I	3	0	0	6
ME322	MACHINE DESIGN	2	0	2	6
ME323	MECHANICAL MEASUREMENTS	3	0	0	6
ME324	HEAT AND MASS TRANSFER	3	1	0	8
ME325	CONTROL SYSTEMS	3	0	0	6
ME326	MECHANICAL LAB - III	0	0	3	3
		14	**1**	**5**	**35**

SEMESTER VII

COURSE NO.	COURSE NAME	L	T	P	C
ME410	SUMMER TRAINING (PP/NP)	0	0	0	0
ME411	APPLIED THERMODYNAMICS - II	3	0	0	6
MExxx	DEPT. ELECTIVE - I	3	0	0	6
MExxx	DEPT. ELECTIVE - II	3	0	0	6
XXxxx	OPEN ELECTIVE - I	3	0	0	6
ME412	MECHANICAL LAB IV	0	0	3	3
ME498	PROJECT - I	0	0	8	8
		12	**0**	**11**	**35**

SEMESTER VIII

COURSE NO.	COURSE NAME	L	T	P	C
ME421	INDUSTRIAL ENGINEERING AND OPERATION RESEARCH	3	0	0	6
MExxx	DEPT. ELECTIVE - III	3	0	0	6
MExxx	DEPT. ELECTIVE - IV	3	0	0	6
HS4xx	HSS ELECTIVE - IV	3	0	0	6
ME499	PROJECT - II	3	0	12	12
		12	**0**	**12**	**36**

CH101 Chemistry (3-1-0-8)

Structure and Bonding; Origin of quantum theory, postulates of quantum mechanics; Schrodinger wave equation: operators and observables, superposition theorem and expectation values, solutions for particle in a box, harmonic oscillator, rigid rotator, hydrogen atom; Selection rules of microwave and vibrational spectroscopy; Spectroscopic term symbol; Molecular orbitals: LCAO-MO; Huckel theory of conjugated systems; Rotational, vibrational and electronic spectroscopy; Chemical Thermodynamics: The zeroth and first law, Work, heat, energy and enthalpies; The relation between C_v and C_p; Second law: entropy, free energy (the Helmholtz and Gibbs) and chemical potential; Third law; Chemical equilibrium; Chemical kinetics: The rate of reaction, elementary reaction and chain reaction; Surface: The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physisorption and chemisorption; The periodic table of elements; Shapes of inorganic compounds; Chemistry of materials; Coordination compounds: ligand, nomenclature, isomerism, stereochemistry, valence bond, crystal field and molecular orbital theories; Bioinorganic chemistry and organometallic chemistry; Stereo and regio-chemistry of organic compounds, conformers; Pericyclic reactions; Organic photochemistry; Bioorganic chemistry: Amino acids, peptides, proteins, enzymes, carbohydrates, nucleic acids and lipids; Macromolecules (polymers); Modern techniques in structural elucidation of compounds (UV-vis, IR, NMR); Solid phase synthesis and combinatorial chemistry; Green chemical processes.

Textbooks:

[1] P. W. Atkins, Physical Chemistry, 5th Ed., ELBS, 1994.

[2] C. N. Banwell, and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw-Hill, 1962

[3] F. A. Cotton, and G. Wilkinson, Advanced Inorganic Chemistry, 3rd Ed., Wiley Eastern Ltd., New Delhi, 1972, reprint in 1988.

[4] D. J. Shriver, P. W. Atkins, and C. H. Langford, Inorganic Chemistry, 2nd Ed., ELBS, 1994.

[5] S. H. Pine, Organic Chemistry, McGraw-Hill, 5th Ed., 1987

References:

[1] I. A. Levine, Physical Chemistry, 4th Ed., McGraw-Hill, 1995.

[2] I. A. Levine, Quantum Chemistry, EE Ed., prentice Hall, 1994.

[3] G. M. Barrow, Introduction to Molecular Spectroscopy, International Edition, McGraw-Hill, 1962.

[4] J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry: Principle, structure and reactivity, 4th Ed., Harper Collins, 1993

[5] L. G. Wade (Jr.), Organic Chemistry, Prentice Hall, 1987.

EE 101. Electrical Science (3-1-0-8)

Circuit Analysis Techniques: Circuit elements, Simple RL and RC Circuits, Ohm's law, Kirchhoff's laws, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Source Transformations, Thevnin's and Norton's Theorems, Sinusoidal Forcing Function, Complex Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Phasor Diagrams, Response as a function of ω.
Diodes and Transistors: Semiconductor Diode, Zener Diodes, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors, Field-Effect Transistors, Transistor Biasing, Transistor Small Signal Analysis, Transistor Amplifiers.
Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Circuits, Active Filters and Oscillators.
Logic Gates and Combinational Circuits: Number Systems and Codes, Logic Gates, Boolean Theorems, DeMogan's Theorems, Sum-of Product Form, Algebraic Simplification, Karnaugh Map Method, Parity Generator and Checker, Inhibit Circuits.
Sequential Circuits and Arithmetic Circuits: NAND and NOR gate Latches, S-C Flip-Flop, J-K Flip-Flop, D Flip-Flop, Data Storage, Serial Data Transfer, Frequency Division and Counting, Binary Addition, 2's Complement System, Full Adder, BCD Adder.
Transformers and AC Machines: Ideal Transformer, Circuit Model of Transformer, Determination of Parameters of Circuit Model of Transformer, Voltage Regulation, Efficiency, Three Phase Induction Motor, Three Phase Synchronous Generator, Induced Voltage, Electromagnetic Torque, Equivalent Circuit of Three Phase Induction Motor, Torque Speed Characteristic.
Fractional-kW Motors and DC Machines: Single Phase Induction Motors, Characteristics and Typical Applications, Stepper Motors, Construction Features, Methods of Operations, DC Generator and DC Motor Analysis, Methods of Excitation, Speed Torque Characteristics and Speed control of DC Machines.
Electrical Engineering Systems: Transmission and Distribution Power Systems, Open-loop and Closed-loop Control Systems, Satellite Control System, Communication System, Amplitude Modulation and Demodulation, Speech Analysis and Synthesis Systems.

Textbooks:

[1] W.H. Hayt and J.E. Kemmerly: Engineering Circuit Analysis; McGraw-Hill, 1993.
[2] R.J. Smith and R.C. Dorf: Circuits, Devices and Systems; John Wiley & Sons, 1992.
[3] R.L. Boylestad and L. Nasheisky: Electronic Devices and Circuit Theory; PHI, 6e, 2001.
[4] R.J. Tocci: Digital Systems; PHI, 6e, 2001.
[5] V. Del Toro: Electrical Engineering Fundamentals; PHI, 1994.

MA 101.Mathematics I (3-1-0-8)

Systems of linear equations and their solutions; vector space Rn and its subspaces; spanning set and linear independence; matrices, inverse and determinant; range space and rank, null space and nullity, eigenvalues and eigenvectors; diagonalization of matrices; similarity; inner product, Gram-Schmidt process; vector spaces (over the field of real and complex numbers), linear transformations.Convergence of sequences and series of real numbers; continuity of functions; differentiability, Rolle's theorem, mean value theorem, Taylor's theorem; power series; Riemann integration, fundamental theorem of calculus, improper integrals; application to length, area, volume and surface area of revolution.

Textbooks:

[1] D. Poole, Linear Algebra: A Modern Introduction, 2nd Edn.,Brooks/Cole, 2005.

[2] G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996..

References:

[1] G. Strang, Linear Algebra and Its Applications, 4th Edn. Brooks/Cole India, 2006.

[2] K. Hoffman and R. Kunze, Linear Algebra, 2nd Edn., Prentice Hall India, 2004

[3] R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Edn., Wiley India, 2005

[4] S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis, Springer India, 2006.

PH 101 Physics - I (2-1-0-6)

Classical Mechanics: Review of Newtonian Mechanics in rectilinear coordinate system. Motion in plane polar coordinates. Conservation principles .Collision problem in laboratory and centre of mass frame.Rotation about fixed axis. Non-inertial frames and pseudo forces .Rigid body dynamics. Special Theory of Relativity: Postulates of STR. Galilean transformation. Lorentz ransformation.Simultaneity.Length Contraction.Time dilation.Relativistic addition of velocities.Energy-momentum relationships. Quantum Mechanics: Two-slit experiment. De Broglie's hypothesis.Uncertainty Principle, wave function and wave packets, phase and group velocities.Schrödinger Equation.Probabilities and Normalization.Expectation values.Eigenvalues and eigenfunctions. Applications in one dimension: Particle in a box, Finite Potential well, Harmonic oscillator.

Textbooks:

[1] D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics, Tata McGraw-Hill, 2000.

[2] R. Eisberg and R. Resnick, Quantum Physics of Atoms,Molecules,Solids,Nuclei and Particles, 2nd Ed., John-Wiley, 1985

.

References:

[1] R. P. Feynman, R. B. Leighton, and M. Sands, The Feynman Lectures on Physics, Vol.I, Norosa Publishing House, 1998.

[2] J.M. Knudsen and P.G. Hjorth, Elements of Newtonian Mechanics, Springer, 1995.

[3] R. Resnick, Introduction to Special Relativity, John Wiley, Singapore, 2000.

[4] A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill, New

ME 110 Workshop - I (0-0-3-3)

Introduction to wood working, hand tools and machines; Introduction to fitting shop tools, equipment and operations; Introduction to sheet metal work; Introduction to pattern making; Introduction to moulding and foundry practice; Simple exercises in wood working, pattern making, fitting, sheet metal work and moulding.

Textbooks:

[1] H. Choudhury, Elements of Workshop Technology, Vol. I, Asia Publishing House, 1986.

[2] H Gerling, All About Machine Tools, New Age International, 1995

[3] W A J Chapman, Workshop Technology, Oxford IBH, 1975

ME 111 Engineering Drawing (1-0-3-5)

Importance of engineering drawing; Conventions and standards: ISO; Scales; Curves; Orthographic projections : points, lines, planes and solids; Sections of solids; Isometric projections; Development of surfaces; Intersection of solids.

Texts:

[1] A.J. Dhananjay, Engineering Drawing, TMH, 2008

[2] N D Bhatt and V M Panchal, Engineering Drawing, 43rd Ed., Charator Publishing House,2001

[3] M B Shah and B C Rana, Engineering Drawing, 2nd Ed., Pearson Education, 2009

References:

[1] T E French, C J Vierck and R J Foster, Graphic Science and Design, 4th Ed., McGraw Hill, 1984.

[2] W J Luzadder and J M Duff, Fundamentals of Engineering Drawing, 11th Ed., PHI, 1995

[3] K Venugopal, Engineering Drawing and Graphics, 3rd Ed., New Age International, 1998

BT 101 Modern Biology (3-1-0-8)

Diversity in biological systems; cell biology and cell structure; biological membranes; bioenergetics; genetics: DNA as genetic material; structure of DNA; DNA replication; transcription; translation; genes to proteins and to protein function; gene expression and regulation; recombinant DNA technology. Human physiology: biological axons and neurons, neuromuscular and synaptic junctions; sensory systems - hearing, taste, smell and visual receptors.

Textbooks:

[1] J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman & Co, 2002.

[2] D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, Macmillan Worth, 2000.

References:

[1] N. Hopkins, J. W. Roberts, J. A. Steitz, J. Watson and A. M. Weiner, Molecular Biology of the Gene, 4th Ed, Benjamin Cummings, 1987.

[2] C. R. Cantor and P. R. Schimmel, Biophysical Chemistry (Parts I, II and III), W.H. Freeman & Co., 1980.

[3] C. C. Chatterjee, Human Physiology, Vol 1 & 2, 11th Ed, Medical Allied Agency, 1987.

CS 101 Introduction to Computing (3-0-0-6)

Introduction: The von Neumann architecture, machine language, assembly language, high level programming languages, compiler, interpreter, loader, linker, text editors, operating systems, flowchart; Basic features of programming (Using C): data types, variables, operators, expressions, statements, control structures, functions; Advanced programming features: arrays and pointers, recursion, records (structures), memory management, files, input/output, standard library functions, programming tools, testing and debugging; Fundamental operations on data: insert, delete, search, traverse and modify; Fundamental data structures: arrays, stacks, queues, linked lists; Searching and sorting: linear search, binary search, insertion-sort, bubble-sort, selection-sort, radix-sort, counting-sort; Introduction to object-oriented programming

Texts:

[1] . A Kelly and I Pohl, A Book on C, 4th Ed., Pearson Education, 1999.

[2] A M Tenenbaum, Y Langsam and M J Augenstein, Data Structures Using C, Prentice Hall India, 1996.

References:

[1] H Schildt, C: The Complete Reference, 4th Ed., Tata Mcgraw Hill, 2000

[2] B Kernighan and D Ritchie, The C Programming Language, 4th Ed., Prentice Hall of India, 1988

MA 102 Mathematics - II (3-1-0-8)

Vector functions of one variable – continuity and differentiability; functions of several variables – continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; tangent planes and normals, maxima and minima, Lagrange multiplier method; repeated and multiple integrals with applications to volume, surface area, moments of inertia, change of variables; vector fields, line and surface integrals; Green's, Gauss' and Stokes' theorems and their applications. First order differential equations – exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem, applications; higher-order linear differential equations – solutions of homogeneous and nonhomogeneous equations, method of variation of parameters, operator method; series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds; systems of first-order equations, phase plane, critical points, stability.

Texts:

[1] G. B. Thomas (Jr.) and R. L. Finney, Calculus and Analytic Geometry, 9th Ed., Pearson Education India, 1996.

[2] S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

References:

[1] T. M. Apostol, Calculus - Vol.2, 2nd Ed., Wiley India, 2003.

[2] W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Ed., Wiley India, 2009.

[3] E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

[4] E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

ME 101 Engineering Mechanics (3-1-0-8)

Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram; Reaction; Static indeterminacy. Structures: Difference between trusses, frames and beams, Assumptions followed in the analysis of structures; 2D truss; Method of joints; Method of section; Frame; Simple beam; types of loading and supports; Shear Force and bending Moment diagram in beams; Relation among load, shear force and bending moment. Friction: Dry friction; Description and applications of friction in wedges, thrust bearing (disk friction), belt, screw, journal bearing (Axle friction); Rolling resistance. Virtual work and Energy method: Virtual Displacement; Principle of virtual work; Applications of virtual work principle to machines; Mechanical efficiency; Work of aforce/couple (springs etc.); Potential energy and equilibrium; stability. Center of Gravity and Moment of Inertia: First and second moment of area; Radius of gyration; Parallel axis theorem; Product of inertia, Rotation of axes and principal moment of inertia; Moment of inertia of simple and composite bodies. Mass moment of inertia. Kinematics of Particles: Rectilinear motion; Curvilinear motion; Use of Cartesian, polar and spherical coordinate system; Relative and constrained motion; Space curvilinear motion. Kinetics of Particles: Force, mass and acceleration; Work and energy; Impulse and momentum; Impact problems; System of particles. Kinematics and Kinetics of Rigid Bodies: Translation; Fixed axis rotational; General plane motion; Coriolis acceleration; Workenergy; Power; Potential energy; Impulse-momentum and associated conservation principles; Euler equations of motion and its application.

Texts:

[1] I.H. Shames, Engineering Mechanics: Statics and Dynamics, 4th Ed., PHI, 2002.

[2] F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 3rd Ed., Tata McGraw Hill, 2000.

References:

[1] J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 5th Ed., John Wiley, 2002.

[2] R. C. Hibbler, Engineering Mechanics, Vols. I and II, Pearson Press, 2002.

PH 102 Physics - II (2-1-0-6)

Vector Calculus: Gradient, Divergence and Curl, Line, Surface, and Volume integrals, Gauss's divergence theorem and Stokes' theorem in Cartesian, Spherical polar, and Cylindrical polar coordinates, Dirac Delta function.

Electrostatics: Gauss's law and its applications, Divergence and Curl of Electrostatic fields, Electrostatic Potential, Boundary conditions, Work and Energy, Conductors, Capacitors, Laplace's equation, Method of images, Boundary value problems in Cartesian Coordinate Systems, Dielectrics, Polarization, Bound Charges, Electric displacement, Boundary conditions in dielectrics, Energy in dielectrics, Forces on dielectrics.

Magnetostatics: Lorentz force, Biot-Savart and Ampere's laws and their applications, Divergence and Curl of Magnetostatic fields, Magnetic vector Potential, Force and torque on a magnetic dipole, Magnetic materials, Magnetization, Bound currents, Boundary conditions.

Electrodynamics: Ohm's law, Motional EMF, Faraday's law, Lenz's law, Self and Mutual inductance, Energy stored in magnetic field, Maxwell's equations, Continuity Equation, Poynting Theorem, Wave solution of Maxwell Equations.

Electromagnetic waves: Polarization, reflection & transmission at oblique incidences.

Texts:

[1] D. J. Griffiths, Introduction to Electrodynamics, 3rd Ed., Prentice-Hall of India, 2005.
[2] A.K.Ghatak, Optics, Tata Mcgraw Hill, 2007.

References:

[1] N. Ida, Engineering Electromagnetics, Springer, 2005.
[2] M. N. O. Sadiku, Elements of Electromagnetics, Oxford, 2006.
[3] R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lectures on Physics, Vol.II, Norosa Publishing House, 1998.
[4] I. S. Grant and W. R. Phillips, Electromagnetism, John Wiley, 1990.

CS 110 Computing Laboratory (0-0-3-3)

Programming Laboratory will be set in consonance with the material covered in CS101. This will include assignments in a programming language like C.

References:

[1] B. Gottfried and J. Chhabra, Programming With C, Tata Mcgraw Hill, 2005

EE 102 Basic Electronics Laboratory (0-0-3-3)

Experiments using diodes and bipolar junction transistor (BJT): design and analysis of half - wave and full-wave rectifiers, clipping circuits and Zener regulators, BJT characteristics and BJT amplifiers; experiments using operational amplifiers (op-amps): summing amplifier, comparator, precision rectifier, astable and monostable multivibrators and oscillators; experiments using logic gates: combinational circuits such as staircase switch, majority detector, equality detector, multiplexer and demultiplexer; experiments using flip-flops: sequential circuits such as non-overlapping pulse generator, ripple counter, synchronous counter, pulse counter and numerical display.

References:

[1] P. Malvino, Electronic Principles, Tata McGraw-Hill, New Delhi, 1993.
[2] R. A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI, New Delhi, 2002.
[3] R.J. Tocci, Digital Systems, 6th Ed., 2001.

MA 201 Mathematics- III (3-1-0-8)

Complex numbers and elementary properties. Complex functions - limits, continuity and differentiation. Cauchy-Riemann equations. Analytic and harmonic functions. Elementary functions. Anti-derivatives and path (contour) integrals. Cauchy-Goursat Theorem. Cauchy's integral formula, Morera's Theorem. Liouville's Theorem, Fundamental Theorem of Algebra and Maximum Modulus Principle. Taylor series. Power series. Singularities and Laurent series. Cauchy's Residue Theorem and applications. Mobius transformations. First order partial differential equations; solutions of linear and nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary and initial value problems (Dirichlet and Neumann type) involving wave equation, heat conduction equationi, Laplace's equations and solutions by method of separation of variables (Cartesian coordinates); initial boundary value problems in non-rectangular coordinates. Laplace and inverse Laplace transforms; properties, convolutions; solution of ODE and PDE by Laplace transform; Fourier series, Fourier integrals; Fourier transforms, sine and cosine transforms; solution of PDE by Fourier transform.

Textbooks:

[1] J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

[2] I. N. Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1957.

[3] S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

References:

[1] T. Needham, Visual Complex Analysis, Oxford University Press, 1999.

[2] J. H. Mathews and R. W. Howell, Complex Analysis for Mathematics and Engineering, 3rd Ed., Narosa,1998.

ME 211 Thermodynamics (2-1-0-6)

Thermodynamic systems; States, processes, heat and work; Zeroth law; First law; Properties of pure substances and steam, Mollier diagram; Second law, Carnot cycle, entropy, corollaries of the second law; Application of first and second laws to closed and open systems; irreversibility and availability, exergy analysis; Thermodynamic relations; Properties of mixtures of ideal gases; Thermodynamic cycles - Otto, Diesel, dual and Joule, Third Law of Thermodynamics.

Texts:

[1] R E Sonntag, C Borgnakke and G J Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003.

[2] G F C Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer , 4th Ed., Pearson 2003.

References:

[1] J P Howell and P O Buckius, Fundamentals of Engineering Thermodynamics, McGraw Hill, 1992.

[2] Y. A. Cengel and M. A. Boles, Thermodynamics, An Engineering Approach, 4th Ed., Tata McGraw Hill, 2003

ME 212 Solid Mechanics - I (2-1-0-6)

Introduction. Stress and strain: stress at a point, Cauchy stress tensor, analysis of deformation and definition of strain components, principal stresses and strains, stress and strain invariants, Mohr's circle representation. Constitutive relations. Material properties for isotropic materials and their relations. Theories of failures for isotropic materials. Shear Force and Bending Moment diagrams. Axially loaded members. Torsion of circular shafts. Stresses due to bending: pure Bending, transverse shear. Combined stresses due to bending, torsion and axially loading. Deflections due to bending. Strain energy due to axial, torsion, bending and transverse shear. Castigliano's theorems. Thin cylinders and spherical vessels. Introduction to buckling of columns.

Texts:

[1] E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1998.

[2] F. P. Beer, E. R. Johnston (Jr.) and J.T. DeWolf, Mechanics of Materials, Tata McGraw Hill, 2005.

References:

[1] S. H. Crandall, N. C. Dahl, and T. J. Lardner, An Introduction To The Mechanics Of Solids, 2nd Ed., Tata McGraw Hill, 2008.

[2] S. P. Timoshenko, Strength of Materials, Vols. 1 & 2, CBS Publishers, 1986.

[3] H. Shames and J. M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, 2003.

[4] J. M. Gere, Mechanics of Materials, Thomson Brooks/Cole, 2006.

ME 213 Engineering Materials (3-1-0-8)

Crystal systems and lattices. Crystallography, crystals and types, miller indices for directions and planes, voids in crystals, packing density in crystals, Crystal imperfections. Characteristics of dislocations, generation of dislocations; Bonds in solids and characteristics of Metallic bonding. Deformation mechanisms and Strengthening mechanisms in structural materials. Principles of solidification: Structural evolution during solidification of metals and alloys. Phase diagrams: Principles, various types of phase diagrams. Iron carbon equilibrium phase diagrams, TTT and CCT diagrams: Pearlitic, martensitic, and bianitic transformations. Various heat treatment processes and hardenability of steels. Hot working and cold working of metals. Recovery, re-crystallization and grain growth phenomenon. General classifications, properties and applications of alloy steels, tool steels, stainless steels, cast irons, copper base alloys, Aluminum base alloys, Nickel base alloys, composites, ceramics and polymers.

Texts:

[1] G.E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
[2] W. D. Callister, Material Science and Engineering And Introduction, Wiley, 2002.

References:

[1] S.R. Askland and P.P. Phule, The Science And Engineering Of Materials, 4th Ed., Thomson Brooks/Cole, 2003.
[2] V. Singh, Physical Metallurgy, Standard Publishers, 1999
[3] W.F. Smith, Principles of Materials Science, McGraw Hill, 1996.
[4] T.V. Rajan, C.P. Sharma and A. Sharma, Heat Treatments: Principles And Techniques, Prentice Hall, 1997.
[5] J.F. Shackelford and M.K. Muralidhara, Introduction Of Materials Science for Engineers, Pearson, 6th Ed., 2010.

ME 214 Machine Drawing (0-0-4-4)

Assembly and Part Drawings of simple assemblies and subassemblies of machine parts viz., couplings, clutches, bearings, gear assemblies, I.C. Engine components, valves, machine tools, etc.; IS/ISO codes; Limits, tolerances and Fits, Surface finish; Symbols for weldments, process flow, electrical and instrumentation units. Introduction to solid modellers. A drawing project on reverse engineering.

Texts:

[1] N.D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996.

[2] N. Sidheswar, P. Kanniah and V.V.S. Sastry, Machine Drawing, Tata McGraw Hill, 1983.

[3] SP 46: 1988 Engineering Drawing Practice for School & Colleges. Bureau of Indian Standards

ME 221 Fluid Mechanics - I (2-1-0-6)

Basic concepts and properties of fluids, Fluid Statics: Hydrostatic pressure distribution; Application to manometry; Hydrostatic forces on submerged plane and curved surfaces; Buoyancy and stability. Fluid Kinematics: Lagrangian and Eulerian description; Deformation of fluid element; Reynolds transport theorem; Fundamentals of flow visualization. Integral relations for a control volume: Conservation equations for mass, momentum and energy; Bernoulli equation. Conservation equations in differential form: Stream function; Velocity potential; vorticity. Dimensional analysis and similitude: Buckingham Pi theorem; Modeling and similarity. Viscous Flow in Ducts: Reynolds number regime; Head loss and friction factor; Laminar fully developed pipe flow; Turbulent pipe flows; Flow in non-circular ducts; Minor losses in pipe systems.

Texts:

[1] F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008.

[2] R.W. Fox, A.T. McDonald and P.J. Pritchard, Introduction to Fluid Mechanics, 6th Ed., John Wiley, 2004

References:

[1] B.R. Munson, D.F. Young and T.H. Okhiishi, Fundamentals of Fluid Mechanics, 5th Ed., Wiley India Edition, 2002.

[2] J.F. Douglas, J.M. Gasiorek, J. A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson Education, 2008.

[3] Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006

ME 222 Manufacturing Technology - I (3-0-0-6)

Introduction to manufacturing processes: Moulding materials and their requirements; Patterns: Types and various pattern materials. Casting processes: Various casting methods, viz., sand casting investment casting, pressure die casting, centrifugal casting, continuous casting, thin roll casting; Mould design; Casting defects and their remedies. Metal joining processes: brazing, soldering, welding; Solid state welding methods; resistance welding; arc welding; submerged arc welding; inert gas welding; Welding defects, inspection. Metal forming Processes: Various metal forming techniques and their analysis, viz., forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling; Super plastic deformation; Metal forming defects. Powder metallurgy and its applications.

Texts:

[1] A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986.
[2] P Rao, Manufacturing Technology: Foundry, Forming And Welding, Tata McGraw Hill, 2008.

References:

[1] J.S Campbell, Principles Of Manufacturing Materials And Processes, Tata McGraw Hill, 1995.
[2] F C Flemmings, Solidification Processing, Tata McGraw Hill, 1982.
[3] P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd., 2003.
[4] S Kalpakjian and S R Schmid, Manufacturing Processes for Engineering Materials, Pearson education, 2009.

ME 223 Solid Mechanics - II (3-0-0-6)

Pre-requisite: ME 212 or equivalent.

Analysis of stresses: 3D state of stress at a point; principal stresses; invariants; 3D Mohr's circle; octahedral stresses; hydrostatic and pure shear stresses. Differential equations of equilibrium in rectangular and polar coordinates. Boundary conditions. Saint-Venant's principle, Principle of superposition. Analysis of strains: 3D strain components in rectangular and polar coordinates; state of strain at a point; principal strains; strain deviators and invariants. Compatibility conditions in rectangular and polar coordinates. Constitutive relations. Boundary value problems: Stress formulation and displacement formulation; Beltrami-Michell equations and Navier's equations. Methods of solution and uniqueness of solution. Plane problems: Plane stress and plane strain problems. Airy stress function. 2D problems in rectangular and polar coordinates and axisymmetric problems: Cantilever beam with end load; uniformly loaded beam; thick and thin walled cylinders; rotating discs and cylinders; plate with a circular hole. Curved beams. Torsion of non-circular bars: Saint-Venant's semi-inverse method; Prandtl's stress function method. Unsymmetrical bending, shear center and shear flow. Energy methods: Principle of virtual work; minimum potential energy; statically indeterminate systems. Elastic stability: Analysis of beam columns. Yield and Fracture criteria: Different failure theories; stress space and strain space; yield surfaces. Introduction to plasticity.

Texts:

[1] S. P. Timoshenko and J. N. Goodier, Theory Of Elasticity, McGraw Hill International, 2010.

[2] L. S. Srinath, Advanced Mechanics Of Solids, Tata McGraw-Hill, 2008.

References:

[1] M. H. Sadd, Elasticity: Theory, Applications And Numerics, Elsevier, 2005.

[2] S. H. Crandall, N. C. Dahl and T. J. Lardner, An Introduction To The Mechanics of Solids, 2nd Ed., Tata McGraw Hill, 2008.

[3] S. P. Timoshenko, Strength Of Materials, Vols. 1 and 2, CBS Publishers, 1986.

[4] H. Shames and J. M. Pitarresi, Introduction To Solid Mechanics, Prentice Hall of India, 2003.

[5] A. C. Ugural and S. K. Fenster, Advanced Strength And Applied Elasticity, 3rd Ed., Prentice Hall, 1994.

[6] A. P. Boresi, R. J. Schmidt and O. M. Sidebottom, Advanced Mechanics Of Materials, 5th Ed., John Wiley, 1993.

[7] Y.C. Fung, Foundations of Solid Mechanics, Prentice-Hall, 1965

ME 224 Kinematics of Machinery (2-1-0-6)

Elements of kinematic chain, mechanisms, their inversions, mobility (Kutzhbach criteria) and range of movements (Grashof's law); Miscellaneous mechanisms: straight line generating mechanism, intermittent motion mechanism; Displacement, velocity and acceleration analysis of planar mechanisms by graphical, analytical and computer aided methods; Dimensional synthesis for motion; function and path generation; Cam profile synthesis and determination of equivalent mechanisms; Gears (spur, helical, bevel and worm); gear trains: simple, compound and epicyclic gearing.

Texts:

[1] K. J, Waldron and G. L Kinzel, Kinematics, Dynamics and Design of Machinery, 2nd Ed., Wiley Student Edition, 2004.

[2] A. Ghosh and A. K. Mallik, Theory of Mechanisms, and Machines, 3rd Ed., East West Press Pvt Ltd, 2009

References:

[1] J. J Uicker (Jr), G. R Pennock and J. E Shigley, Theory of Machines and Mechanisms, 3rd ed., Oxford International Student Edition.

[2] S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill, 2009.

[3] R. L. Norton, Kinematics and Dynamics of Machinery, Tata Mcgraw Hill, 2009.

[4] J. S. Rao, R. V. Dukkipati, Mechanism and Machine Theory, 2nd Ed., New Age International, 2008.

[5] A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.

[6] T. Bevan, Theory of Machines, CBS Publishers and Distributors, 1984

ME 225 Workshop - II (0-0-6-6)

Introduction to machine tools and machining processes; Types of cutting tools; Selection of cutting speeds and feed;Simple machining operations on lathe, shaping, slotting, milling and grinding machines; Modern trends in manufacturing,automation, NC/CNC, FMS, CAM and CIM.

Texts:

[1] H. Choudhury, H. Choudhary and N. Roy, Elements of Workshop Technology, Vols. I and II, Media Promoters and Publishers Pvt. Ltd., 2007.

[2] W. A. J. Chapman, Workshop Technology, Vol. 1 (2001), Vol 2 (2007), and Vol. 3 (1986), CBS Publishers.

[3] H Gerling, All About Machine Tools, New Age International, 1995.

ME 226 Mechanical Engineering Laboratory - I (0-0-3-3)

Strength of materials: Tensile testing of steel, hardness, torsion, and impact testing; Fluid Mechanics and hydraulics: Flow through restrictive passages like orifice, venturi, weirs and notches, head losses in piping systems. Demonstration of various mechanisms and gear systems.

ME 311 Fluid Mechanics - II (3-0-0-6)

Pre-requisite: ME 221 or equivalent.

Viscous Flow and Boundary Layer Theory: Introduction to Navier-Stokes Equations; Boundary-layer equations; Momentum integral estimates; Laminar flat plate boundary layer – Blasius equation; Displacement and momentum thickness; Boundary layers with pressure gradient; Flow separation; Turbulent flat plate boundary layers. Compressible Flow: The speed of sound; Adiabatic and isentropic steady flow - Mach-number relations, Isentropic flow with area changes; Normal-shock wave - Rankine-Hugoniot relations; Mach waves, oblique shock wave, Prandtl Meyer expansion waves; Performance of nozzles; Fanno and Rayleigh flow. Turbomachines: Euler-equation for turbo-machines; Impulse turbine- Pelton wheel; Reaction turbine- Francis turbine, propeller turbine; Centrifugal pump; Performance parameters and characteristics of pumps and turbines; Cavitation; Net positive suction head (NPSH); Role of dimensional analysis and similitude; Positive displacement pumps.

Texts:

[1] F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008.

[2] R.W. Fox, A.T. McDonald and P.J. Pritchard, Introduction To Fluid Mechanics, 6th Ed., John Wiley, 2004

References:

[1] B.R. Munson, D.F. Young, and T.H. Okhiishi, Fundamentals Of Fluid Mechanics, 5th Ed., Wiley India Edition, 2002.

[2] J. D. Anderson (Jr.), Modern Compressible Flow, McGraw-Hill International Edition, 1990.

[3] Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006.

[4] J.F. Douglas, J.M. Gasiorek, J. A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson Education, 2008.

[5] S.L. Dixon, Fluid Mechanics And Thermodynamics Of Turbomachinery, 5th Ed., Elsevier, 1998

ME 312 Manufacturing Technology - II (3-0-0-6)

Metal Cutting: Mechanics, tools (material, temperature, wear, and life considerations), geometry and chip formation; surface finish and machinability; optimization; Machine tool: Generation and machining principles; Setting and Operations on machines: lathe, milling (including indexing), shaping, slotting, planing, drilling, boring, broaching, grinding (cylindrical, surface, centreless), thread rolling and gear cutting machines; Tooling: Jigs and fixtures, principles of location and clamping; Batch production: CNC machines; Finishing: Microfinishing (honing, lapping, superfinishing); Unconventional methods: electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining etc.; Rapid prototyping and rapid tooling.

Texts:

[1] A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986.
[2] G K Lal, Introduction To Machining Science, New Age International Pvt Ltd., 2007.

References:

[1] Production Technology, H M T Publication, Tata McGraw Hill, 1980.
[2] M C Shaw, Metal Cutting Principles, MIT Press, 2004.
[3] P K Mishra, Nonconventional Machining, Narosa Publishing House, 1997

ME 313 Dynamics of Machinery (2-1-0-6)

Static and dynamic force analysis; Flywheel; inertia forces and their balancing for rotating and reciprocating machines; Gyroscope and gyroscopic effects; Governers: types and applications; Cam dynamics: analysis of cam and follower, jump phenomenon; Vibrations of one degree of freedom systems; Free and Force vibrations; Transverse and torsional vibrations of two and three rotor systems; critical speeds; Vibration isolation and measurements; two-degree of freedom systems; Geared system; Introduction to Multi-degree of Freedom System :normal mode vibration, coordinate coupling, forced harmonic vibration, vibration absorber (tuned, and centrifugal pendulum absorber), vibration damper; Properties of vibrating system, flexibility matrix, stiffness matrix, reciprocity theorem, eigenvalues and eigenvectors, orthogonal properties of eigenvectors, modal matrix, Rayleigh damping, Normal mode summation.

Texts:

[1] J. J Uicker (Jr), G. R Pennock, and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition, 2009.

[2] J S Rao and R V Dukkipat, Mechanism and Machine Theory, 2nd Ed., New Age Intl., 2008

References:

[1] S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill, 2009.

[2] T. Bevan. Theory of Machines, CBS Publishers and Distributors, 1984.

[3] L. Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1998.

[4] W. T. Thomsom and M.D. Dahleh, Theory of Vibration with Applications, 5th Ed., Pearson Education, 1999.

ME 314 Design of Machine Elements (3-0-0-6)

Principles of mechanical design; Factor of safety, strength, rigidity, fracture, wear, and material considerations; Stress concentrations; Design for fatigue; Limits and fits; Standardization; Design of riveted, bolted, and welded joints; Rigid and flexible couplings; Belt and chain drives; Power screws; Shafts; Keys; Clutches; Brakes; Axles; Springs.

Texts:

[1] Design Data Book of Engineers, Compiled by Faculty of Mechanical Engineering, PSG College of Technology, Publisher Kalaikathir Achchagam, Coimbataore, 2009.

[2] M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram, and C. V. Venkatesh, Design of Machine Elements, 8th Ed., Person Education, 2006

References:

[1] J. E. Shigley, Mechanical Engineering Design, McGraw Hill, 1989.

[2] A. H. Burr and J. B. Cheatham, Mechanical Analysis and Design, 2nd Ed., Prentice Hall, 1997.

[3] V B Bhandari, Design of Machine Elements, 2nd Ed., Tata Mcgraw Hill, 2007.

[4] R. C Juvinall and K. M Marshek, Fundamentals of Machine Component Design, 3rd Ed., Wiley Student Edition, 2007.

ME 315 Mechanical Engineering Laboratory - II (0-0-3-3)

Metallography: microscopic techniques, determination of volume fraction of different phases in material including metals, estimation of grain sizes, study of heat affected regions in welded steel specimen; Machining processes: Measurement of tool angles and radius for single point cutting tool, determination of cutting forces, shear plane, chip thickness ratio, profile estimation using coordinate measuring machine; Theory of machines: Static and dynamic balancing (multi-plane) of rotary systems, gyroscope, governors, whirling of shafts, simple and compound pendulums, determination of moment of inertia using trifilar suspension, torsional vibration; Experiments in conduction, free and forced convection, heat exchangers, petrol and diesel engines.

ME 321 Applied Thermodynamics - I (3-0-0-6)

Pre-requisite: ME 211 or equivalent.

Vapour Power Cycles: Carnot cycle, Rankine cycle, reheat cycle, regenerative cycle, steam cycles for nuclear power plant, back-pressure and extraction turbines and cogeneration, low-temperature power cycles, ideal working fluid and binary/multi-fluid cycles; Steam Generator: subcritical and supercritical boilers, fluidized bed boilers, fire-tube and watertube boilers, mountings and accessories; Condenser; Cooling Tower: hygrometry and psychrometric chart; Steam Turbine: impulse and reaction stage, degree of reaction, velocity triangle, velocity and pressure compounding, efficiencies, reheat factor, governing, nozzles; Heat Pump and Refrigeration Cycles: reversed Carnot cycle and performance criteria, vapour compression and vapour absorption refrigerators, gas cycles, refrigerants and environmental issues; Air-conditioning; Reciprocating Air Compressors: work transfer, volumetric efficiency, isothermal efficiency, multistage compression with intercooling.

Texts:

[1] G. F. C Rogers and Y. R. Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4th Ed., Pearson, 2003.

[2] T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th Ed., Pearson, 2003.

References:

[1] M. J. Moran and H N Shapiro, Fundamentals of Engineering Thermodynamics, 3rd Ed., John Wiley, 1995.

[2] M. M. ElWakil, Power Plant Technology, McGraw Hill International, 1992.

[3] P. K. Nag, Powerplant Engineering, 2nd Ed., Tata McGraw Hill, 2002.

ME 322 Machine Design (2-0-2-6)

Pre-requisite: ME 314 or equivalent

Design of Gears; Lubrication and Wear consideration in Design; Design and selection of Bearings: Hydrodynamic lubrication theory, Hydrostatic and Hydrodynamic bearings (e.g., journal), Rolling Element Bearings; Systems Approach to Design: Decision Making, Simulation of mechanical systems using CAD tools, Sensitivity analysis of design parameters, Value Analysis and Value Addition to designed components and systems; Exercises of mechanical systems design with examples; Overview of Optimization in Design; Reliability and Robust Design; Communicating the Design.

Texts:

[1] Design Data Book of Engineers, Compiled by Faculty of Mechanical Engineering, PSG College of Technology, Publisher Kalaikathir Achchagam, Coimbataore, 2009

[2] J. E. Shigley, Mechanical Engineering Design, McGraw Hill, 1989

References:

[1] M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram and C V Venkatesh, Design of Machine Elements, 8th Ed., Person Education,2006.

[2] V. B. Bhandari, Design of Machine Elements, 2nd Ed., Tata Mcgraw Hill, 2007.

[3] R. C. Juvinall and K. M Marshek, Fundamentals of Machine Component Design, 3rd Ed., Wiley Student Edition, 2007.

[4] V. Ramamurti, Computer Aided Mechanical Design and Analysis, 3rd Ed., Tata McGraw Hill, 1996.

[5] A. H. Burr and J. B. Cheatham, Mechanical Analysis and Design, 2nd Ed., Prentice Hall, 1997.

[6] J. R. Dixon, Design Engineering: Inventiveness, Analysis and Decision Making, TMH, New Delhi, 1980.

ME 323 Mechanical Measurements (3-0-0-6)

Fundamentals of Measurement: Elements of a generalized measurement system, standards, and types of signals ; Static performance characteristics. Dynamic performance, instrument types - zero, first and second order instruments, transfer function representation, system response to standard input signals - step, ramp, impulse, and frequency response; Treatment of uncertainties: error classification, systematic and random errors, statistical analysis of data, propagation and expression of uncertainties; Measurement of various physical quantities: Linear and angular displacement, velocity, force, torque, strain, pressure, flow rate and temperature; Transfer functions of some standard measuring devices; Data Acquisition and processing: Digital methods, digitization, signal conditioning, interfacing, standard methods of data analysis – quantities obtainable from time series; Fourier spectra, DFT, FFT; Data acquisition parameters - sampling rate, Nyquist sampling frequency, aliasing & leakage errors; Metrology: measurement of angles, threads, surface finish, inspection of straightness, flatness and alignment, gear testing, digital readouts, coordinate measuring machine.

Texts:

[1] E.O. Doebelin, Measurement systems- Applications and Design, 4th Ed., Tata McGraw-Hill, 1990.

[2] T.G. Beckwith, R.D. Marangoni and J.H. Lienhard, Mechanical Measurements, 5th Ed., Addison Wesley, 1993.

References:

[1] R.S. Figiola and D.E. Beasley, Theory and design for mechanical measurements, 2nd Ed., John Wiley, 1995.

[2] J.W. Dally, W.F. Riley and K.G.McConnell, Instrumentation for engineering measurements, 2nd Ed., John Wiley & Sons, 1993.

[3] E.O. Doebelin, Engineering Experimentation, McGraw-Hill, 1995.

[4] R.K. Jain, Engineering Metrology, Khanna Publishers, New Delhi, 1997

ME 324 Heat and Mass Transfer (3-1-0-8)

Modes of heat transfer; Conduction: 1-D and 2-D steady conduction; 1-D unsteady conduction-Lumped capacitance and analytical methods; Fins. Convection: fundamentals, order of magnitude analysis of momentum and energy equations; hydrodynamic and thermal boundary layers; dimensional analysis; free and forced convection; external and internal flows; heat transfer with phase change. Radiation: Stefan-Boltzmann law; Planck's law; emissivity and absorptivity; radiant exchange between black surfaces. Heat exchangers: LMTD and NTU methods; heat transfer enhancement techniques. Mass transfer: molecular diffusion; Fick's law; analogy between heat and mass transfer; evaluation of mass transfer coefficients by dimensional analysis.

Texts:

[1] F. P. Incropera and D. P. Dewitt, Fundamentals Of Heat And Mass Transfer, 5th Ed., John Wiley and Sons, 2009.

[2] J. P. Holman, Heat Transfer, 9th Ed., McGraw Hill, 2007.

References:

[1] M. N. Ozisik, Heat Transfer-A Basic Approach, McGraw Hill, 1985.

[2] A. Bejan, Convective Heat Transfer, 3rd Ed., John Wiley and Sons, 2004.

[3] F. Kreith and M. S. Von, Principles of Heat Transfer, 6th Ed., Brook and Cole Publication, 2001.

ME 325 Control Systems (3-0-0-6)

Feedback systems, mathematical modelling of physical systems; Laplace transforms, block diagrams, signal flow graphs, state-space models; Time domain analysis: performance specifications, steady state error, transient response of first and second order systems; Stability analysis: Routh-Hurwitz stability criterion, relative stability; proportional integral, PI, PD, and PID controllers; Lead, lag, and lag-lead compensators; Root-locus method: analysis, design; Frequency response method: Bode diagrams, Nyquist stability criterion, performance specifications, design; Statespace methods: analysis, design; Physical realizations of controllers: hydraulic, pneumatic, and electronic controllers.

Texts:

[1] K Ogata, Modern Control Engineering, 4th Ed., Pearson Education Asia, 2002.

[2] B C Kuo and F. Golnaraghi, Automatic Control Systems, 8th Ed., John Wiley (students ed.), 2002.

References:

[1] M Gopal, Control Systems: Principles and Design, 2nd Ed., TMH, 2002.

[2] M Gopal, Modern Control System Theory, 2nd Ed., New Age International, 1993.

[3] R. C. Dorf and R. H. Bishop, Modern Control Systems, 8th Ed., Addison Wesley, 1998.

[4] P. Belanger, Control Engineering: A modern approach, Saunders College Publishing, 1995.

ME 326 Mechanical Engineering Laboratory - III (0-0-3-3)

Metrology: Use of various metrological tools like slip, angle gauge, feeler, taper, fillet, thread gauges, estimation of internal dimensions; CNC machine trainer, CNC coding; Data acquisition: Using data acquisition systems, programming a virtual instrument using standard interfaces; Turbomachinery: Centrifugal and positive displacement pumps, Pelton and propeller turbines.

ME 410 Summer Training (PP/NP) (0-0-0-0)

Training for a minimum period of 8 weeks in a reputed industry / R&D lab / academic institution except IIT Guwahati. The student is expected to submit a report and present a seminar after the training.

ME 411 Applied Thermodynamics - II (3-0-0-6)

Pre-requisite: ME 211 or equivalent

I. C. Engines: Classification - SI, CI, two-stroke, four-stroke etc., operating characteristics – mean effective pressure, torque and power, efficiencies, specific fuel consumption etc., air standard cycles – Otto, Diesel and dual, real air-fuel engine cycles, Thermochemistry of fuels – S.I. and C.I. engine fuels, self ignition, octane number, cetane number, alternate fuels etc., combustion – combustion in S.I. and C.I. engines, pressure-crank angle diagram, air-fuel ratio, chemical equation and conservation of mass in a combustion process etc., Air and fuel inje ction – injector and carburetor, MPFI etc., ignition, lubrication, heat transfer and cooling; Gas Power Cycles: Simple gas turbine cycle – single and twin shaft arrangements, intercooling, reheating, regeneration, closed cycles, optimal performance of various cycles, combined gas and steam cycles; Introduction to Axial-Flow Gas Turbine; Introduction to Centrifugal and AxialFlow Compressors; Combustion Chambers; Jet Propulsion: turbojet, turboprop, turbofan, ramjet, thrust and propulsive efficiency; Rocket Propulsion; Direct Energy Conversion: thermionic and thermoelectric converters, photovoltaic generators, MHD generators, fuel cells.

Texts:

[1] G. F. C. Rogers and Y. R. Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4 th Ed., Pearson, 2001.

[2] H. I. H Saravanamuttoo, G. F. C. Rogers and H. Cohen, Gas Turbine Theory, 4 th Ed., Pearson, 2003.

References:

[1] T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th Ed., Pearson, 1999.

[2] W. W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, PHI, 2002.

[3] C. R. Fergusan and A. T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons, 2001

ME 412 Mechanical Engineering Laboratory - IV (0-0-3-3)

Instrumentation and control: Proportional, integral, PI, PD, and PID controllers, lead, lag, and lag-lead compensators, hydraulic, pneumatic, and electronic controllers; Tribology: Performance of air bearings, friction and wear testing under different operating conditions, optical viscometry; Vibration: Experiments on single and multi degree of freedom systems, modal and frequency response analysis, vibration isolation, random vibrations; Acoustics: Measurement of sound pressure level with various frequency weightings, sound power estimation withsound pressure pressure level; signals and Systems: Time domain and spectral analysis with software such as MATLAB; determination of FFT, PSD; effects of sampling, windowing, leakage, averaging

ME 421 Industrial Engineering and Operations Research (3-0-0-6)

Introduction, Production Planning and Control, Product design, Value analysis and value engineering, Plant location and layout, Equipment selection, Maintenance planning, Job, batch, and flow production methods, Group technology, Work study, Time and motion study, Incentive schemes, Work/job evaluation, Inventory control, Manufacturing planning: MRP, MRP-II, JIT, CIM, Quality control, Statistical process control, Acceptance sampling, Total quality management, Taguchi's Quality engineering. Forecasting, Scheduling and loading, Line balancing, Break-even analysis. Introduction to operations research, linear programming, Graphical method, Simplex method, Dual problem, dual simplex method, Concept of unit worth of resource, sensitivity analysis, Transportation problems, Assignment problems, Network models: CPM and PERT, Queuing theory.

Texts:

[1] S. L. Narasimhan, D. W. McLeavey, and P. J. Billington, Production, Planning and Inventory Control, Prentice Hall, 1997.

[2] J. L. Riggs, Production Systems: Planning, Analysis and Control, 3rd Ed., Wiley, 1981.

References:

[1] Muhlemann, J. Oakland and K. Lockyer, Productions and Operations Management, Macmillan, 1992.

[2] H. A. Taha, Operations Research - An Introduction, Prentice Hall of India, 1997.

[3] J. K. Sharma, Operations Research, Macmillan, 1997.