MATERIAL SCIENCE AND METALLURGY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- To understand the fundamentals of materials, structures and its related mechanical properties
- To understand the concepts of deformation, Fracture, Creep and Fatigue under different loading conditions
- To impart knowledge on different solidification mechanism and thereby construct the different types of phase diagram
- To familiarize the concept of Iron Carbon equilibrium diagram and study the microstructure for various kinds of heat treatment and classify Ferrous Nonferrous and Composite materials

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Crystal Structure** BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Ficks laws of diffusion, factors affecting diffusion. **Mechanical Behaviour** Stress-strain diagram for ductile and brittle materials, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness.	**10 Hours**	
Module-2		
Plastic deformation: of single crystal by slip and twinning. **Fracture**: Types, Griffith's criterion of brittle fracture, **Creep**: Description of Creep phenomenon with examples. three stages of creep, creep properties, stress relaxation. **Fatigue**: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.	**10 Hours**	

Module -3		
Solidification Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures. Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule. **Phase Diagram II** Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Different types invariant reactions – Eutectic, Eutectoid, Peritectic, Peritectectoid reactions etc.	**10 Hours**	
Module -4		
Iron carbon equilibrium diagram Description of phases, solidification of steels and cast irons, invariant reactions. **Heat treating of metals** TTT curves, continuous cooling curves, description of the following heat treatmen processes with industrial applications: annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminum-copper alloys.	**10 Hours**	
Module -5		
Ferrous and non ferrous materials Properties, Composition and uses of • Grey cast iron, malleable iron, SG iron and steel • Copper alloys-brasses and bronzes. • Aluminum alloys-Al-Cu,Al-Si,Al-Zn alloys. • Titanium alloys **Composite Materials** Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP's and MMC's advantages and application of composites.	**10 Hours**	

Course outcomes:

- Will be able to classify the different crystal structure and relate the different properties of material by making use of stress strain diagram
- Will be able to illustrate Slip and Twinning, Fracture, Creep and Fatigue under different loading conditions
- Will be able to compare the different solidification mechanism and construct the different types of phase diagram
- Will be able to analyze the Iron Carbon diagram and compare the microstructure for various kinds heat treatment. Will be able to classify Ferrous Nonferrous and Composite materials

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. Foundations of Materials Science and Engineering, Smith, 4th Edition McGraw Hill, 2009
2. Materials Science, Shackleford., & M. K. Muralidhara, Pearson Publication – 2007.

Reference Books:

1. An Introduction to Metallurgy; Alan Cottrell, Universities Press India Oriental Longman Pvt. Ltd., 1974.
2. Engineering Materials Science, W.C.Richards, PHI, 1965
3. Physical Metallurgy; Lakhtin, Mir Publications
4. Materials Science and Engineering, V.Raghavan , PHI, 2002
5. Elements of Materials Science and Engineering, H. VanVlack, Addison-Wesley Edn., 1998
6. Materials Science and Engineering,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. The Science and Engineering of Materials, Donald R. Askland and Pradeep.P. Phule, Cengage Learning, 4lh Ed., 2003.

BASIC THERMODYNAMICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- To study fundamentals of thermodynamics, its laws, energy interactions, various temperature scales and its measurements.
- To provide the detailed information of thermodynamic laws and its various physical problems
- To understand the behavior of pure substance and its applications in practical problems
- To provide the necessary knowledge in various thermodynamic relations and its applications to ideal gas mixtures

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Fundamental Concepts & Definitions** Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes. Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements. **Work and Heat** Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.	**10 Hours**	

Module -2		
First Law of Thermodynamics Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer. **Second Law of Thermodynamics** Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.	**10 Hours**	
Module -3		
Entropy Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate, numerical problems. Available and unavailable energy. Reversible work and irreversibility, (no numerical problems) **Pure Substances** P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality),T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter	**10 Hours**	

Module -4		
Thermodynamic relations Helmholtz and Gibbs functions, .Maxwell relation, Clausius Clayperon's equation .Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy .enthalpy and entropy in various quasi-static processes.	**10 Hours**	
Module -5		
Ideal gas mixture Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various processes. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart, Redllich Kwong equation ,Beattie-bridgeman equation	**10 Hours**	

Course outcomes:

- Students will be able to acquire the fundamentals of thermodynamics, its laws, energy interactions, various temperature scales and its measurements
- Students will be able to analyze and apply the laws of thermodynamics to various physical problems
- Students will be able to interpret the behavior of pure substance and its applications to practical problems
- Students will be equipped with the various thermodynamic relations and its applications to ideal gas mixtures

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. Thermodynamics-an Engineering Approach, Yunus A.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002
2. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

Reference Books:

1. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
2. Fundamentals of Classical Thermodynamics, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
3. An Introduction to Thermodynamics, Y.V.C.Rao, Wiley Eastern, 1993,
4. B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics, PHI,New Delhi, 2010

FLUID MECHANICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

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Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Properties of Fluids**: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation. **Fluid Statistics**: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.	**10 Hours**	
Module -2		
Buoyancy and Fluid Kinematics: Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically. Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity potential function and stream function. **Fluid Dynamics** Introduction to equation of motion, Introduction to Navier-Stokes equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.	**10 Hours**	
Module -3		
Fluid Flow Measurements Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.	**10 Hours**	

Dimensional Analysis Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitudes		
Module -4		
Flow through pipes Minor losses through pipes. Darcey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL. **Laminar flow and viscous effects** Reyonold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates.	**10 Hours**	
Module -5		
Flow past immersed bodies Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness. Introduction to compressible flow: Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.	**10 Hours**	
Course outcomes: •		
Graduate Attributes (as per NBA): o		
Question paper pattern:		
Text Books: 1. Fluid Mechanics (SI Units), Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006 2. Fluid Mechanics, Dr. Bansal, R.K.Lakshmi Publications, 2004.		
Reference Books: 1. Fluid Mechanics, Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005. 2. Fluid Mechanics and hydraulics, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997. 3. Fluid Mechanics, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006 4. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons, 2004 5. Fluid Mechanics -. Merle C. Potter, Elaine P.Scott. Cengage learning		

COMPUTER AIDED MACHINE DRAWING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME35	IA Marks	20
Number of Lecture Hours/Week	06 (2 hrs. Theory and 4 hrs Practical)	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- Know and comprehend the standards of machine drawing practiced by Bureau of Indian standards (B.I.S.)
- Understand general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional objects in Two-dimensional views
- Knowledge on Assemble of machine elements in mechanical engineering applications
- Knowledge of modern engineering software tools for mechanical engineering design and analysis

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Introduction Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.	**02 Hours**	
Module -1 **Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic Views:** Conversion of pictorial views into orthographic projections. of **simple machine parts** with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.	**06 Hours**	
Module -2		
Thread Forms Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.	**08 Hours**	

Fasteners Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen		
Module -3		
Keys: Parallel key, Taper key, Feather key, Gibhead key and Woodruff key **Riveted Joints:** Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.	**08 Hours**	
Module -4		
Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)	**08 Hours**	
Module -5		
Assembly Drawings **(Part drawings should be given)** 1. Plummer block (Pedestal Bearing) 2. Rams Bottom Safety Valve 3. I.C. Engine connecting rod 4. Screw jack (Bottle type) 5. Tailstock of lathe 6. Machine vice 7. Tool Head of a shaper	**18 Hours**	

Course outcomes:

- Students will be able to understand the steps in producing drawings according to bureau of Indian standards (B.I.S.)
- Students will be able to understand and create drawings of machine parts and their assemblies
- Students can work effectively with engineering and science teams as well as with multidisciplinary designs
- Students will be able to skilfully use modern engineering software tools for mechanical engineering design and analysis

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.
2. A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007.

Reference Books:

1. Machine Drawing', N.D.Bhat & V.M.Panchal.

NON-CONVENTIONAL ENERGY SCIENCES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME361	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	52	Exam Hours	03

CREDITS – 04

Course objectives:

- To provide detailed information of the present energy scenario and the available NCES
- To provide a detailed insight knowledge in basics of solar radiation geometry and various measurement techniques available
- To understand the solar energy through solar thermal devices, PV conversion and their performance analysis.
- To understand the conceptual knowledge about the various energy conversion methods such as wind ,Tidal, OTEC, Geothermal, Biomas and Hydrogen energy and their impact on environment and sustainability

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Introduction**: Energy source, India's production and reserves ofcommercial energy sources, need for non-conventional energy sources. **Solar Radiation** : Extra-Terrestrial radiation, spectral distribution of extraterrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data. **Measurement of Solar Radiation**: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.	**10 Hours**	
Module -2		
Solar Radiation Geometry: Flux on a plane surface, latitude, declinationangle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples.	**10 Hours**	

Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation,expression for flux on a tilted surface (no derivations) numerical examples. **Solar Thermal Conversion** : Collection and storage, thermal collectiondevices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis);		
Module -3		
Performance Analysis of Liquid Flat Plate Collectors: General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product , numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.	**10 Hours**	
Module -4		
Photovoltaic Conversion: Description, principle of working andcharacteristics, applications. **Wind Energy**: Properties of wind, availability of wind energy in India, windvelocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills. **Tidal Power**: Tides and waves as energy suppliers and their mechanics;fundamental characteristics of tidal power, harnessing tidal energy, limitations **Ocean Thermal Energy Conversion** : Principle of working, Rankine cycle, **Geothermal Energy Conversion** : Principle of working, types of geothermalstation with schematic diagram.	**10 Hours**	
Module -5		
Energy from Bio Mass : Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.	**10 Hours**	

Hydrogen Energy : Properties of Hydrogen with respected to its utilizationas a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production.		

Course outcomes:

- Students will be able to understand the present energy scenario and the available NCES
- Students will get a thorough insight in to the basics of solar radiation geometry and various measurement techniques available
- Students can analyze and apply the knowledge gained in tapping the solar energy through solar thermal devices, pv conversion and their performance analysis
- Students will have a complete knowledge about the various energy conversion methods such as wind, Tidal, OTEC, Geothermal, Biomas and Hydrogen energy and their impact on environment and sustainability.

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. Non-Conventional Energy Sources by *G.D Rai K*, Khanna Publishers, 2003.
2. Solar energy, by *Subhas P Sukhatme* – Tata McGraw Hill, 2 nd Edition, 1996.
3. Non-Conventional Energy sourses, Khan, TMH

Reference Books:

1. Renewable Energy Sources and Conversion Technology by *N.K.Bansal, Manfred Kleeman & Mechael Meliss*, Tata McGrawHill, 2001.
2. Renewable Energy Resources, *John W.Twidell Anthony D. Weir El*, BG 2001.
3. Solar Power Engineering, *P.K.Nag*, Tata McGraw Hill, 2003.

SMART MATERIALS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME362	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	52	Exam Hours	03

CREDITS – 04

Course objectives:

- Apply the mechanics of composites and smart materials in the product design process
- Design innovative products/structures by applying knowledge in advanced materials and technology including smart materials and intelligent technology
- Identify the limitations and constraints by using advanced materials at different environments
- Consider environmental factors during the product design process

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Introduction:** Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics **Control Design:** Design of shape memory alloys, Types of MR fluids, Characteristics and application, principles of MR fluid value designs, Magnetic circuit design, MR Dampers, Design issues	**10 Hours**	
Module -2		
Sensing And Actuation: Principles of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer conventional and advanced materials, signal processing, principles and characterization	**10 Hours**	
Module -3		
Structures: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects. **Optics And Electromagnetic:** Principles of optical fiber technology, characteristics of active and adaptive optical system and components, design and manufacturing principles.	**10 Hours**	

Module -4		
Controls: Principles of structural acoustic control, distributed, analog and digital feed back controls, Dimensional implications for structural control.	**10 Hours**	
Module -5		
Principles Of Vibration And Modal Analysis: PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications. **Information Processing:** Neural Network, Data Processing, Data Visualisation and Reliability – Principles and Application domains.	**10 Hours**	

Course outcomes:

- Understand, and apply knowledge of composites, smart materials for various engineering applications
- Able to design structures using smart materials
- Able to Identify the limitations and constraints by using advanced materials at different environments
- Able to design products based on environmental issues

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. **Analysis and Design',** A. V. Srinivasan, 'Smart Structures –Cambridge Universities Press, New York, 2001, (ISBN : 0521650267)
2. **'Smart Materials and Structures',** M V Gandhi and B SThompson Chapmen & Hall, London, 1992 (ISBN : 0412370107)

Reference Books:

1. **'Smart Materials and Structures',** Banks HT, RC Smith, Y Wang, Massow S A, Paris 1996
2. **G P Gibss'Adaptive Structres',** Clark R L, W R Saunolers, JhonWiles and Sons, New York, 1998
3. **An introduction for scientists and Engineers',** Esic Udd, OpticSensors : Jhon Wiley & Sons, New York, 1991 (ISBN : 0471830070)

NANO SCIENCE

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	15ME363	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- To understand the fundamentals of Nanotechnology
- To give a general introduction to different classes of nanomaterials
- To impart basic knowledge on various synthesis and characterization techniques involved in Nanotechnology
- To make the learner familiarize with nanotechnology potentialities

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **An Overview Of Nano-Science & Nanotechnology** – historical background – nature, scope and content of the subject – multi disciplinary aspects – industrial, economic and societal implications. **Experimental Techniques And Methods** for investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes – light scattering – x-ray diffraction	**10 Hours**	
Module -2		
Fullerenes – discovery, synthesis and purification – chemistry of fullerenesin the condensed phase – orientational ordering – p ressure effects – conductivity and superconductivity – ferromagnetism – optical properties. **Carbon Nanotubes** – synthesis and purification – filling of nanotubes –mechanism of growth – electronic structure – transp ort properties – mechanical and physical properties – applications.	**10 Hours**	
Module -3		
Self-Assembled Monolayers – monolayers on gold – growth process – phasetransitions – patterning monolayers – mixed monolay ers – applications. **GAS PHASE CLUSTERS** – history of cluster science – formation andgrowth – detection and analysis – type and properti es of clusters – bonding in clusters	**10 Hours**	

Module -4		
Semiconductor Quantum Dots – synthesis – electronic structure ofnanocrystals – how quantum dots are studied – corre lation of properties with size – uses. **Monolayer-Protected Metal Nanoparticles** – method of preparation–characterization – functionalized metal nanoparticl es – applications – superlattices. **Core-Shell Nanoparticles** – types – characterization – properties –applications. **Nanoshells** – types – characterization – properties – applications.	**10 Hours**	
Module -5		
Nanobiology – interaction between biomolecules and nanoparticle surfaces –materials used for synthesis of hybrid nano-bio assemblies – biological applications – nanoprobes for analytical applicatio ns – nanobiotechnology – future perspectives. **Nanosensors** – what make them possible – nanoscale organization forsensors – characterization – nanosensors based on o ptical properties – nanosensors based on quantum size effects – electro chemical sensors – sensors based on physical properties – nanobiosenso rs – sensors of the future. **Nanomedicines** – approach to development – nanotechnology in diagn osticand therapeutic applications.	**10 Hours**	

Course outcomes:

- Understand, and apply knowledge of nanomaterials, nanotransducers & NEMS for various engineering applications
- Classify, analyze and validate Nanosensors, in electronics, mechanical, chemical, and biological systems
- Evaluate and create nano Design, Devices and Systems in various disciplines.
- Interpret and experiment with implementation and characterization processes.

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. **NANO: The Essentials – Understanding Nanoscience an d Nanotechnology;** T Pradeep (Professor, IIT Madras); TataMcGraw-Hill India (2007)
2. **Nanotechnology:** Richard Booker & Earl Boysen; Wiley (2005).

Reference Books:

1. **Introduction to Nanoscale Science and Technology [Series: Nanostructure Science and Technology],** Di Ventra, et al (Ed);Springer (2004)
2. **Nanotechnology Demystified,** Linda Williams & Wade Adams;McGraw-Hill (2007)
3. **Introduction to Nanotechnology,** Charles P Poole Jr, Frank JOwens, Wiley India Pvt. Ltd., New Delhi, 2007.

DATABASE MANAGEMENT SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	**15ME364**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- Students should understand, design and implement a data base management system
- Students should develop high level conceptual model for database design

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Database And Database Users:** Introduction, characteristics of databaseapproach, intended uses of a DBMS, advantages and implementation of database approach. **Database Systems Concepts And Architecture:** Data models, schemes andinstances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.	**10 Hours**	
Module -2 **Data Modeling:** High level conceptual data models for database design.Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.	**10 Hours**	
Module -3 **Record Storage And Primary File Organizations:** Secondary storagedevices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques. **Relational Data Model And Relational Algebra:** Brief discussion on coderules, relational model concepts,	**10 Hours**	

constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.		
Module -4		
Structural Query Language (Sql): Data definition etc., in SQL2. Basic andcomplex queries in SQL, Inser, Delete; Update statements, and views in SQKL, embedded SQL.	**10 Hours**	
Module -5		
Database Design: Design guidelines for relational schemas, functionaldependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems. **System Implementation:** System catalogue for RDBMSs, transactionprocessing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.	**10 Hours**	

Course outcomes:

- Able to understand the basic concepts of Data Base Management System (DBMS)
- Able to develop high-level conceptual data models for database design.
- Able to handle all operations of files like heap file, sorting files, hashing techniques, etc.,
- Able to design and implement a data base management system.

Graduate Attributes (as per NBA):

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Question paper pattern:

Text Books:

1. **Fundamentals of Database Systems,** Ramez Elmasri andShanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System,** Raghu Ramakrishnan, Tata McGraw Hill, 3rd Edn. 2002.

Reference Books:

1. **Database Management and Design,** Gray W.hansen and James V.Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems,** Designing and Building businessapplications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM,** Moder Joseph J andPhillips cerel, R., VAN Noserand, Reinhold, 2ndEdn., 1976.

MATERIAL TESTING LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Laboratory Code	15MEL37	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
		Exam Hours	03
CREDITS – 02			

Course objectives:

- To Determine the mechanical properties of different material specimen
- To give the basic knowledge about the methods to enhance the properties of the material from heat treatment process
- To gain the basic knowledge about wear characteristics of ferrous, nonferrous and composite materials
- To gain the practical knowledge about Non-destructive testing

Laboratory Experiments: **NOTE:**	**Revised Bloom's Taxonomy (RBT) Level**
PART A	
1. Preparation of specimen for Metallograpic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.	
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.	
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameter using pin-on-disk apparatus.	
4. Non-destructive test experiments like, (a). Ultrasonic flaw detection (b). Magnetic crack detection (c). Dye penetration testing. (d) To study the defects of Cast and Welded specimens	
PART B	
1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine	
2. Torsion Test	

3. Bending Test on metallic and nonmetallic specimens.	
4. Izod and Charpy Tests on M.S, C.I Specimen.	
5. Brinell, Rockwell and Vickers's Hardness test.	
6. Fatigue Test.	

Course outcomes:

- Students will be able to demonstrate the knowledge and skills to conduct and analyzing the results w.r.t. Hardness testing, Tensile testing, Shear, Compression, Bending test, Fracture testing, Fatigue testing and Impact testing
- Students will be able to get the basic knowledge about the methods to enhance the properties of the material from heat treatment process
- Students will be able to study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters
- Students will able to get the practical knowledge about Non-destructive testing

Graduate Attributes (as per NBA)

-

Conduct of Practical Examination:

Reference Book:

MACHINE SHOP LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Laboratory Code	15MEL38	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives:

- To Provide an insight into different kinds of machine tools
- To provide training to students to enrich their practical skills
- To inculcate team qualities among the students
- To train the students based on ethical, environmental and safety issues

Laboratory Experiments: **NOTE:**	**Revised Bloom's Taxonomy (RBT) Level**
PART A	
Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.	
PART B	
Cutting of V Groove/ dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine.	

Course outcomes:

- Will be able to demonstrate the various skills of Turning, facing, knurling, thread cutting
- Will be able to operate lathe machine, milling machine, shaping machines safely
- Will be able to work effectively with the others as a team
- Conduct themselves ethically and responsibly in machine shop

Graduate Attributes (as per NBA)

-

Conduct of Practical Examination:

Reference Book:

KINEMATICS OF MACHINERY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	15ME42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

- To identify and enumerate different link based mechanisms with basic understanding of motion
- To interpret and analyse various velocity and acceleration diagrams for various mechanisms
- To understand and illustrate various power transmission mechanisms using suitable methods
- To design and evaluate the performance of different cams and followers

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Links and Mechanisms:** Definitions Link or Element, Kinematic Pairs, Degrees of Freedom, Grubler's Criterion (without derivation), Kinematic Chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. Kinematic Chains and Inversions: Inversions of Four Bar Chain; Single Slider Crank Chain and Double Slider Crank Chain.Mechanisms: Quick Return Motion Mechanisms:- Drag Link Mechanism, Whitworth Mechanism and Crank & Slotted Lever Mechanism. Straight Line Motion Mechanisms:- Peaucellier's Mechanism and Robert's Mechanism. Intermittent Motion Mechanisms: - Geneva Wheel Mechanism and Ratchet & Pawl Mechanism, Toggle Mechanism, Pantograph	**10 Hours**	
Module -2		
Velocity and Acceleration Analysis of Mechanisms(Graphical Method & Analytical Method) : Velocity and Acceleration Analysis of Four Bar Mechanism, Slider Crank Mechanism and Simple Mechanisms by Vector Polygons: Relative Velocity, and Acceleration of Particles in a Common Link, Relative Velocity and Accelerations of Coincident Particles on Separate links - Coriolis Component of Acceleration. Angular Velocity and Angular Acceleration of Links,	**10 Hours**	

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of Linear and Angular Velocity Using Instantaneous Center Method		
Module -3		
Spur Gears: Gear Terminology, Law of Gearing, Characteristics of Involute Action, Path of Contact, Arc of Contact, Contact Ratio of Spur, Helical, Bevel & Worm gears, Interference in Involute Gears. Methods of Avoiding Interference, Backlash. Comparison of Involute &Cycloidal Teeth. Profile Modification.	**10 Hours**	
Module -4		
Gear Trains: Simple Gear Trains, Compound Gear Trains for Large Speed. Reduction, Epicyclic Gear Trains, Algebraic & Tabular Methods of Finding Velocity Ratio of Epicyclic Gear Trains. Tooth Load & Torque Calculations in Epicyclic Gear Trains.	**10 Hours**	
Module -5		
Cams: Types of Cams, Types of Followers. Displacement, Velocity & Acceleration Time Curves for Cam Profiles. Disc Cam with Reciprocating Follower Having Knife-Edge, Roller & Flat-Face Follower, Disc Cam With Oscillating Roller Follower. Follower Motions including, SHM, Uniform Velocity, Uniform Acceleration & Retardation and Cycloidal Motion.	**10 Hours**	

Course outcomes:

- To identify and enumerate different link based mechanisms with basic understanding of motion
- To interpret and analyse various velocity and acceleration diagrams for various mechanisms
- To understand and illustrate various power transmission mechanisms using suitable methods
- To design and evaluate the performance of different cams and followers

Graduate Attributes (as per NBA):

Question paper pattern:

Text Books:

1. "**Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd Ed-2009
2. "**Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Ed 2006

Reference Books:

1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley, OXFORD 3rd Ed. 2009

APPLIED THERMODYNAMICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	**15ME43**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Combustion thermodynamics:** Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flame temperature, Numerical problems.	**10 Hours**	
Module -2		
Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles. Numerical problems **I.C. Engine:** Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test. Numerical problems	**10 Hours**	
Module -3		
Vapour Power Cycles:	**10 Hours**	

Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T-S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle. Numerical problems on simple Rankine cycles only **Reciprocating Compressors:** Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work, optimum intermediate pressure, inter- cooling, minimum work for compression. Numerical problems.		
Module -4		
Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion. Numerical problems **Refrigeration:** Definition COP, Carnot cycle, Air cycle refrigeration; reversed Brayton cycle, Numerical Problems	**10 Hours**	
Module -5		
Refrigeration: Vapour compression refrigeration system ; description, Refrigerants and their desirable properties. analysis, refrigerating effect, capacity , power required, units of refrigeration, Numerical Problems, Vapour absorption refrigeration system, steam jet refrigeration.(No numerical Problems) **Psychometry:** Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures ,specific and relative humidities and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychometric chart . Analysis of various	**10 Hours**	

processes; heating, cooling ,dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning. Numerical problems		
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002 2. **Applied Thermodynamics**, Rajput, Laxmi Publication 3. **Applied Thermodynamics**, B.K. Venkanna, Swati B. Wadavadagi, PHI, New Delhi, 2010		
Reference Books: 1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002, 2. **Fundamental of Classical Thermodynamics,** G.J. Van Wylen and R.E.Sontang Wiley eastern		

MECHANICAL MEASUREMENTS AND METROLOGY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	**15ME44**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Measurement:** Standards of Measurement**,** Definition and Objectives of metrology Micrometer and its types, vernier calipers, angle plates, sprit levels, standards, Wave length standard, subdivision of standards, line and and standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges. **Comparators:** Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators, Zeiss ultra optimeter, electric and electronic comparators,LVDT, pneumatic comparators, back pressure gauges, solex comparators	**10 Hours**	
Module -2		
System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wearallowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.	**10 Hours**	

Module -3		
Interferometer, screw thread, gear measurement and Angular measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier and gear tooth micrometer. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.	**10 Hours**	
Module -4		
Measurement systems, Flow measurement and Vibration Measurement: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. Introduction to flow measurement, Positive displacement methods, Rotameter, turbine meter, ultrasonic flowmeter, Hotwire anemeter, Magnetic flowmeter, Introduction to vibration measurements, two simple vibration instruments, Principles of seismic instrument.	**10 Hours**	
Module -5		
Measurement of force, torque, pressure, temperature and strain measurement: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements,	**10 Hours**	

strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement		
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006. 2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, 1994. .		
Reference Books: 1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002, 2. **Fundamental of Classical Thermodynamics,** G.J. Van Wylen and R.E.Sontang Wiley eastern		

Mechanics of Materials

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – IV

Subject Code	**15 ME45**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Stress and Strain:** Definition of Stress, Strain and Stress-strain relations, Mechanical behaviour of materials, Linear elasticity, Young's modulus of elasticity and Poisson's ratio, Stress-Strain curves in tension for Mild steel, Cast iron and non-ferrous metals. Bars of uniform cross section, varying cross section and discontinuous/stepped cross section, Extension / Shortening under point (axial) load, body force (self weight), temperature change, Compound bars, Composite Sections, Numerical examples	**10 Hours**	
Module -2		
Compound Stress: Uniaxial, Biaxial, General 2D stress state, Definition of Plane stress and Plane strain states, Stresses on inclined sections, Principal stresses, Principal planes, Principal axes, Maximum shear stress, Mohr's circle, Numerical examples. Expression for Volumetric strain, Elastic constants, Numerical examples **Cylinders:** Determination of deformations, strains and stresses in thin cylinders subjected to internal pressure, Numerical examples	**10 Hours**	
Module -3		

Bending Moment and Shear Force diagrams: Types of beams, loads and reactions, Definition of shear force and bending moment, sign conventions, Relationship between shear force, bending moment and rate of loading, Shear force and bending moment diagrams for different beams, Numerical examples involving beams subjected to concentrated loads, uniformly distributed load (UDL), uniformly varying load (UVL) and couple	**10 Hours**	
Module -4		
Stresses in Beams: Euler-Bernoulli beam theory, Relationship between bending moment, bending stress, and radius of curvature. Transverse Shear stresses, shear stress across rectangular, circular, symmetrical I- and T-sections only, Numerical examples. **Deflection of Beams** : Governing differential equation and its solution, Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method, Numerical examples	**10 Hours**	
Module -5		
Torsion of shafts with circular cross section: Derivation of governing equation, Torsional rigidity, Torsional strength, Power transmitted by solid and hollow shafts, Numerical examples **Elastic stability of Columns:** Euler's theory for axially loaded elastic long columns, Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula, Numerical examples	**10 Hours**	
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. **Mechanics of Maerials, Ramamrutham** 2. **Mechanics of Materials,** in SI Units, Ferdinand Beer and Russell Johston, 5th Ed., TATA McGraw Hill- 2003. 3. **Mechanics of Materials,** R. C. Hibbeler, Prentice Hall. Pearson Edu., 2005 4. **Mechanics of Materials,** James M. Gere, Thomson, Fifth Edition, 2004.		
Reference Books:		

ORGANIZATIONAL BEHAVIOUR & PROFESSIONAL COMMUNICATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	**15ME461**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives:

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **Introduction:** Definition of Organization Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems). **The Individual**: Foundations of individual behaviour, individual differences. Ability. Attitude, Aptitude, interests. Value.	**10 Hours**	
Module -2		
Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.	**10 Hours**	
Module -3		
Perception: Definition, Factors influencing perception, attribution theory,selective perception, projection, stereotyping, Halo effect**.** **Motivation:** Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X andY, Hertzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation**.**	**10 Hours**	

Module -4		
The Groups: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making**.** **Principles Of Communication:** Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication**.**	**10 Hours**	
Module -5		
Conflict & Stress Management: Definition of conflict, functional and dysfunctional conflict, stages of conflict process**.** Sources of stress, fatigue and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process**.**	**10 Hours**	
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		

Text Books:

1. **Organizational Behaviour,** Stephen P Robbins, 9thEdition,Pearson Education Publications, ISBN-81-7808-561-5 2002
2. **Organizational Behaviour,** Fred Luthans, 11thEdition, McGrawHill International Edition, ISBN-0-07-120412-12002

Reference Books:

1. **Organizational Behaviour,** Hellriegel, Srocum and Woodman,Thompson Learning, 9th Edition, Prentice Hall India, 2001
2. **Organizational Behaviour,** Aswathappa - Himalaya Publishers.2001
3. **Organizational Behaviour,** VSP Rao and others, KonarkPublishers.2002
4. **Organizational Behaviour,** (Human behaviour at work) 9thEdition,JohnNewstron/ Keith Davis. 2002

BIOMASS ENERGY SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	**15ME462**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives:

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Introduction:** Biomass energy sources, energy content of various Bio –fuels, Energy plantation, origin of Biomass photo synthesis process, Biomass Characteristics, sustainability of Biomass. **Biomass ConversionMethods:** Agrochemical, Thermo chemical, Biochemical (flowchart) & Explanation.	**10 Hours**	
Module -2		
Physical & Agrochemical Conversion: Briquetting, Pelletization, Agrochemical, fuel Extraction, Thermo chemical Conversion: Direct combustion for heat, Domestic cooking & heating.	**10 Hours**	
Module -3		
Biomass Gasification: Chemical reaction in gasification, Producergas& the constituents, Types of gasifiers. Fixed bed gasifiers, Fluidized bed gasifiers. Liquefaction: Liquefaction through pyrolysis & Methanol synthesis, application of producer gas in I C Engines.	**10 Hours**	
Module -4		
Bio-Methanization: Anaerobic digestion, Basic principles, factors influencing Biogas yield, classification of Biogas	**10 Hours**	

digester, floating gasholder & fixed dome type.(Working Principle with diagram), Calculations for sizing the Biogas plant. **Biogas For Power Generation:** Ethanol as an automobile fuel, Ethanol production & its use in engines.		
Module -5		
Bio - Diesel: Bio Diesel from edible & non-edible oils, Production of Biodiesel from Honge&Jatropha seeds, use of bio diesel in I C engines, Engine power using Bio diesel, Blending of Bio diesel, Performance analysis of diesel engines using bio diesel. Effect of use of bio diesel in I C engines. **Bio Power Plants:** Bio Power generation routes, Basic Thermodynamiccycles in Bio power generation; Brayton cycle, Sterling cycle, Rankine cycle, Co-generation cycle. Biomass based steam power plant.	**10 Hours**	
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. **Bio Gas Technology,** B.T. Nijaguna. New Age International-NewDelhi.2001-02 2. **Energy Technology,** S. Rao & B. B. Parulekar – Khanna Publishers, Delhi-1999. 3. **Non Conventional Energy Sources,** G. D. Rai – Khanna Publishers. Delhi.		
Reference Books: 1. **Greenhouse Technology for Controlled Environment,** G.N.Tiwari, Alpha Science International Ltd., Pangbourne.England. 2. **Renewable Energy Resources,** John.W.Twidell, Anthony. D. Weir,EC BG-2001. 3. **BioMass, Deglisc. X and P. Magne,** Millennium Enterprise, New Delhi.		

MANAGEMENT INFORMATION SYSTEM [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	**15ME462**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives:

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **The Information Age:** An Overview: The purpose, data, information, and information systems and their types, ethical and societal issues, information systems in business functions, web empowered enterprises. **Strategic Uses of Information Systems:** Strategies and Strategic moves, Achieving a competitive advantage, creating and maintaining strategic information systems, Business Functions and Supply Chains – effectiveness and efficiency, accounting, finance, engineering, supply chain management, Human resource management, Enterprise resource planning.	**10 Hours**	
Module -2		
Information Technology: Business Hardware – components, classification of computers, output devices, storage media, and purchasing,, Business Software – programming languages and software development tools, language translation, compilers and interpreters, system software, open source software, software licensing, ethical issues,	**10 Hours**	
Module -3		
Business Networks and Telecommunication: Telecommunication in Business and Daily Use,	**10 Hours**	

Bandwidths and Media, networks, protocols, internet networking services, Telecommuting – pros and cons, Future of Networking Technologies. **Web Enabled Commerce:** Web enabled enterprises – web business and technologies, web enabled business, Challenges of Global Information Systems – Multinational organizations, international commerce, ethical issues.		
Module -4		
Decision Support and Business intelligence: Decision support and expert systems – decision support and decision making process, structured and unstructured problems, decision support systems, expert systems, geographical systems, Business Intelligence and Knowledge Management – Data Mining and online analysis, knowledge management,	**10 Hours**	
Module -5		
Planning, Acquisition, and Control: Systems Planning and Development –Planning Information systems, systems development life cycle, agile methods, systems integration, ethical issues – IS professionals certification. **Choices in Systems Acquisition:** Options and Priorities, out sourcing, licensing applications, software as a service, user application development, ethical issues- computer use policies for employees	**10 Hours**	
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. **Management Information Systems**, Effy Oz, CengageLearning,INDIA EDITION, 2009. 2. **Management Information Systems**, James A O'Brien, Irwin, 9th Ed., McGraw Hill.		
Reference Books: 1. **Management Information Systems,** Laudon&Laudon, PHI 1998Ed. ISBN 81-203-1282-1 2. **Management Information systems,** S.Sadagopan, Prentice Hall ofIndia, 1998 Ed. ISBN 81-203-1180-9 **Information systems for Modern management** G.R.Murdick PHI2002.		

Engineering Design

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – IV

Subject Code	**15ME464**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The purpose of this course is to expose the beginning student of engineering to the typical methodology of problem solving used by the engineer
In the design of products, processes or systems for satisfying man's needs

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 Definition of engineering design with illustrations, place of design in engineering activity, life cycle of product, design morphology, design process methodologies, basic methodology for problem solving. Recognition of design problems needs analysis, design requirements, formulation of design problems	**10 Hours**	
Module -2		
Analysis of design problem, description of inputs and outputs, weightages & trade-offs among requirements, criteria for comparison & evaluation of solution, identification of constraints, pair wise comparison chart, objective trees, work breakdown structures Synthesis of alternative solutions, creativity & techniques for creative idea generation & evaluation of solutions.	**10 Hours**	
Module -3		
Design communication & presentation, design and the environment, professional ethics in engineering, design for manufacture, design for assembly, design for reliability & design for affordability	**10 Hours**	
Module -4		
Design communication & presentation, design and the environment, professional ethics in engineering, design for manufacture, design for assembly, design for reliability & design for affordability	**10 Hours**	

Module -5		
Manufacturing considerations in design – A brief overview of conventional manufacturing processes like casting, forging, welding, machining, powder metallurgy Note: the following course topics will be covered by the instructors through 10 – 15 lectures and design case studies, major learning by the student will be through a number of tutorial exercises	**10 Hours**	
Course outcomes: Major learning by the student will be through a Design case studies, number of tutorial exercises, design problem solving assignments, a group design seminar and group design project		
Graduate Attributes (as per NBA):		
Question paper pattern:		
Text Books: 1. C. L. Dym, Patrick Little Engineering Design A project Based Introduction, John Wiley, 1995. **2.** N. Cross, Engineering Design Methods & Strategies for Product Design, John Wiley, 1995.		
Reference Books: 1. Ian Wright, Design Methods in Engineering & Product Design, McGraw-Hill, 1998. 2. M. A. Parameswaran, An Introduction to Design Engineering, Narosa, 2004. 3. Atila Ertas, Jesse C. Jones, The Engineering Design Process, John Wiley, 1993.		

ENERGY LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	**15MEL47**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	42	Exam Hours	03

CREDITS – 04

Course objectives:

PART – A	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus. 2. Determination of Calorific value of solid, liquid and gaseous fuels. 3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers. 4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke). 5. Use of planimeter	**21 Hours**	
PART – B	**21 Hours**	
1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A: F Ratio heat balance sheet for (a) Four stroke Diesel Engine (b) Four stroke Petrol Engine (c) Multi Cylinder Diesel/Petrol Engine, (Morse test) (d) Two stroke Petrol Engine (e) Variable Compression Ratio I.C. Engine.		

Course outcomes:

Graduate Attributes (as per NBA):

Question paper pattern:

MECHANICAL MEASUREMENTS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	**15MEL48**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	42	Exam Hours	03
CREDITS – 04			

Course objectives:

PART – AMECHANICAL MEASUREMENTS	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
1. Calibration of Pressure Gauge 2. Calibration of Thermocouple 3. Calibration of LVDT 4. Calibration of Load cell 5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.	**21 Hours**	
PART – B METROLOGY	**21 Hours**	
1. Measurements using Optical Projector / Toolmaker Microscope. 2. Measurement of angle using Sine Center / Sine bar / bevel protractor 3. Measurement of alignment using Autocollimator / Roller set 4. Measurement of cutting tool forces using a) Lathe tool Dynamometer b) Drill tool Dynamometer. 5. Measurement of Screw thread Parameters using Two wire or Three-wire method. 6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator 7. Measurement of gear tooth profile using gear tooth		

vernier /Gear tooth micrometer 8. Calibration of Micrometer using slip gauges 9. Measurement using Optical Flats		
Course outcomes:		
Graduate Attributes (as per NBA):		
Question paper pattern:		