Index

3ME1A: MECHANICS OF SOLIDS

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**

3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Stress and Strain:** Elementary definition of stress and strain, stress-strain relationship, elastic, plastic and visco-elastic behavior of common materials in tension and compression test, stress-strain curves, Hooke's law, Poisson's ratio, elastic constants and their relations for an isotropic hookean material, anisotropic and orthotropic materials.	3
	Tension, compression, shearing stress and strain, thermal stresses, composite bars, equations of static equilibrium, concept of free body diagram. Strain energy due to axial loading.	5
II	**Members Subjected to Flexural Loads:** Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams.	4
	bending stresses, section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc. Strain energy due to bending.	5
III	**Principal Planes, Stresses and Strains:** Members subjected to combined axial, bending and torsional loads, maximum normal and shear stresses, concept of equivalent bending and equivalent twisting moments, Mohr's circle of stress and strain.	5
	Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.	2
IV	**Torsion:** Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Strain energy due to torsional loads.	4
	Stability of Equilibrium: Instability and elastic stability, long and short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.	4
V	**Transverse Deflection of Beams:** Relation between deflection, bending moment, shear force and load, transverse deflection of beams and shaft under static loading, area moment method, direct integration method.	6
	Thin-walled Pressure Vessels: Stresses in cylindrical and spherical vessels	2
	TOTAL	40

TEXT BOOK		
1	Bansal, R. K., "A Textbook of Strength of Materials Laxmi Publications.	2010
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Timoshenko, S.P., and Gere, J.M., "Mechanics of Materials", 2nd Ed., CBS Publishers	2002
2	Crandall, S.H., Dahl, N.C., and Lardner, T.J., "An Introduction to the Mechanics of Solids", Tata McGraw-Hill	1999
3	Pytel and Kiusalaas, "Mechanics of Materials" Cengage Learning	2011
4	Punmia, Jain and Jain, "Mechanics of Materials", Laxmi Publication	2002
5	Popov, E.P., Nagarajan, S., and Lu, Z. A., "Mechanics of Materials", 2nd Ed., Prentice-Hall of India	2002

3ME2A: MATERIAL SCIENCE AND ENGINEERING

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Crystal structure – BCC, FCC and HCP, unit cell, crystallographic planes and directions, miller indices. Crystal imperfections, point, line, surface and volume defects.	4
	Frank Reed source of dislocation, Elastic & plastic modes of deformation, Bauschinger's effect, slip & twinning, strain hardening, cold/hot working recovery, re-crystallization and grain growth.	4
II	Classification of Engineering Materials: Solidification of metals and of some typical alloys, mechanism of crystallization (I) nuclear formation (ii) crystal growth, general principles of phase transformation in alloys, phase rule and equilibrium diagrams, equilibrium diagram of binary system having complete mutual solubility in liquid state and limited solubility in solid state, binary isomorphous alloy system, Hume-Rothery rule , binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with a peritectic transformation, equilibrium diagram of a system whose components are subject to allotropic change.	5
	Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram, eutectic, peritectic, eutectoid and peritectoid reactions and microstructures.	3
III	Isothermal transformation diagrams –cooling curves superimposed on Isothermal Transformation diagram, critical cooling rate. (i) Formation of Austenite from Pearlite (ii) Transformation of Austenite into Pearlite.	4
	Full annealing, stress relief, spheroidizing – normalizing, hardening and tempering of steel. Hardenability, Jominey end quench test – Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding. Flame and Induction hardening.	4
IV	Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO,PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes.	4
	Constitution of alloys: Solid solutions - substitutional and interstitial. Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA steel.	4
V	Mechanical Properties and Testing: Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.	4
	Classification of steels and cast iron constitution and properties. BIS standards. Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ etc. Fiber and particulate reinforced composites and resin plastics. Introduction to Nano materials- Nano structured materials. Nano clusters & Nano crystals.	4
		40

TEXT BOOK		
1	Material Science and Engineering An Introduction, William D.Callister, John Wiley and Sons.	2003
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Material Science, Raghvan V., Prentice Hall India	2012

2	Principles of Material Science and Engineering, William F.Smith, Tata McGraw-Hill Publications.	**2008**
3	Engineering Physical Metallurgy, Lakhtin Y., Mir Publisher.	
4	Introduction to Engineering materials Tata McGraw-Hill Publications.	**2011**
5	Engineering materials properties and selection Budinski and Budinski, PHI	**2003**

3ME3A: ENGINEERING THERMODYNAMICS

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Basic Concepts and definitions of Thermodynamics**: System, Surroundings, Property, Energy, Thermodynamic Equilibrium, Process, work and modes of work.	**2**
	Zeroth and First Law of Thermodynamics: Zeroth of Thermodynamics**,** Temperature scale, First law of thermodynamics, First law analysis of some elementary processes. Steady and unsteady flow energy equations.	**5**
II	**Second Law of Thermodynamics:** Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausis Inequality.	**4**
	Entropy: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume.	**3**
	Availability: Available energy, Loss in available energy, Availability Function, Irreversibility.	**3**
III	**Thermodynamic Properties of Fluids:** Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart	**4**
	Ideal Gas and Real Gas: Ideal gas, Real gas, Internal energy, enthalpy and specific heats of an ideal gas, equations of state, Dalton's law of partial pressures, Gibbs Dalton law, Thermodynamic properties of gas mixtures.	**4**
IV	**Thermodynamic Relations:** Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation.	**4**
	Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.	**5**
V	Vapour power cycle: Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle	**3**
	Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Nag P.K., Engineering Thermodynamics, Tata Mc-Graw Hill	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Chattopadhyay P., Engineering Thermodynamics, Oxford University Press.	**2011**
2	Van G.J. Wylen and Sonntag R.E., Fundamental of Thermodynamics,	**2003**

	John Wiley &Sons	
3	Cengel Y.A. and. Boles M.A, Thermodynamics-An Engineering Approach, McGraw Hill	**2011**
4	Jones J.B.&.Dugan R.E, Engineering Thermodynamics, Prentice Hall of India.	**1996**
5	Rao Y.V.C., An Introduction to Thermodynamics, Wiley Eastern Ltd.	**1993**
6	Moran M.J and H.N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley and Sons	**1996**
7	Rogers, Gorden., Engineering Thermodynamics, Pearson Education	**1996**

3ME4A: MANUFACTURING PROCESSES

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	General Classification and Introduction to Manufacturing processes. **Foundry Technology:** Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification.	**4**
	Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy	**5**
II	**Forming Processes:** Classification; Hot working and cold working; principle, advantages, disadvantages and applications. Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials.	**3**
	Rolling: Characteristics and applications of hot rolling and cold rolling; Extrusion; Work materials and products; Press tool works; Basic principles, system, operations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing, Drawing: wire drawing, tube drawing and deep drawing.	**4**
	Design of blanks for blanking, piercing and drawing operations. Estimation of forces and power required for shearing and drawing operations. Introduction to Spinning, Bulging, Coining, embossing, cold heading and riveting process; Metal working defects.	**4**
III	**Metal Joining Processes**: Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Laser beam welding.	**4**
	Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings	**4**
IV	**Powder Metallurgy:** Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.	**3**
	Rapid Prototyping Operations: Introduction, subtractive processes, additive processes, Virtual Prototyping and applications	**3**
V	**Plastic Technology:** Classification of Plastics, Ingredients of Moulding	**3**

	compounds, General Properties of Plastics,	
	Plastic part manufacturing processes such as compression moulding, transfer moulding, injection moulding, extrusion moulding, blow moulding, calendaring, thermoforming, slush moulding, laminating.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Rao.P.N., Manufacturing Technology, Vol. 1,2 and 3, Tata McGraw Hill	**2013**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Ghosh, A., & Mallik, A. K. 1986. Manufacturing Science: Ellis Horwood.	
2	Schey, Introduction to Manufacturing Processes, Tata McGraw Hill	**1999**
3	Kalpakjian, S., & Schmid, S. R., Manufacturing processes for engineering materials, Pearson Education.	**2000**
4	Campbell, J. S. Principles of manufacturing materials and processes: Tata McGraw-Hill	**2008**
5	Heine, R.W., Loper, C.R., and Rosenthal, P.C., "Principles of Metal casting", Tata McGraw Hill.	**1999**
6	Groover, M.P., Fundamentals of Modern Manufacturing: Materials, Processes and systems, Prentice Hall, New Jersey	**1976**
7	Kalpakjian, S. & Schmid S.R, Manufacturing Engineering and Technology, Addison Wesley Longman	**2007**
8	Little, R.L., Welding and welding technology Tata McGraw-Hill Education	**2000**
9	Shan, H.S., Manufacturing Process, Pearson Education.	**1973**

3ME5A: OBJECT ORIENTED PROGRAMMING IN C ++

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**
2L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Introduction to Object Oriented Programming: Basic concepts: Class, Object, Method, Message passing, Inheritance, Encapsulation, Abstraction, Polymorphism.	**2**
	Basics of C++ Environment: Variables; Operators; Functions; user defined, passing by reference, passing an array to the function, inline function, scope, overloading;	**3**
II	Pointers: objects and lvalue, arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions;	**3**
	Strings: String I/O, character functions in ctype.h, string functions in string.h.	**2**
III	Object oriented concepts using C++: Classes: Member functions, Friend functions, Constructors, Access functions, Private member functions, class destructor, static data and function members;	**2**
	Overloading: inline functions, this operator, overloading various types of operators, conversion operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance, protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes.	**3**
IV	Templates and Iterators: function and class templates, container classes, subclass templates, iterator classes;	**3**
	Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library.	**2**
V	Data Structures Using C++: Linked lists – Singly linked list, Doubly linked lists, Circular lists,	**3**

	Stacks and Queues priority Queues, Stacks, Queues.	**2**
	TOTAL	**25**

TEXT BOOK		
1	Balaguruswamy E.: Object Oriented Programming in C++ , McGraw Hill Education (India)	**2007**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Sahay: OBJECT ORIENTED PROGRAMMING WITH C++ , Oxford	**2006**
2	Hubbard, John., Programming with C++ , McGraw Hill Education (India)	**2006**
3	Rambaugh James etal, "Object Oriented Design and Modelling", PHI.	
4	Budd, Timothy, "An Introduction to Object Oriented Programming", Pearson Education	**2008**
5	Venugopal, K.R., Mastering C++, McGraw Hill Education (India)	**1997**
6	Ravichandra, D., Programming with C++, McGraw Hill Education (India)	**2007**

3ME6A: ADVANCED ENGINEERING MATHEMATICS

B.Tech. (Mechanical) 3rd semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Fourier transform: Discrete and Fast Fourier transforms, Complex form of Fourier transform and its inverse, Fourier sine and cosine transform and their inversion. Properties of F-transform, Convolution theorem for F-transform, Parse Val's identity for F-transforms.	**5**
	Applications of Fourier transform: Applications of Fourier transform for the solution of partial differential equations having constant coefficients with special reference to heat equation and wave equation.	**3**
II	Laplace Transform: Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Differentiation and integration of transforms.	**5**
	Applications of Laplace Transform: Applications of Laplace Transform to the solution of ordinary and partial differential equations having constant coefficients with special reference to the wave and diffusion equations.	**4**
III	Probability: Basic Concepts of probability, Conditional Probability, Baye's Theorem.	**4**
	Random Variable and distributions: Discrete and continuous random variable, Moments, Expectation, Moment generating function, Binomial, Poisson and Normal distribution.	**6**
IV	Numerical Analysis –I: Finite differences, Difference operators: forward, Backward, central and average operators. Newton's forward and backward interpolation formula, Stirling's central difference formula Lagrange's interpolation formula for unequal interval.	**6**
V	Numerical Analysis –II: Numerical differentiation, Numerical integration trapezoidal rule, Simpson's one third and three eight rule. Numerical solution of ordinary differential equation of first order: Picard's method, Euler's, and modified Euler's, method, Milne's methods and Runga Kutta fourth order method.	**7**
	TOTAL	**40**

TEXT BOOK		
1	Y. N.Gaur and C.L. Koul , Advanced Engineering Mathematics, Jaipur Publishing House, Jaipur.	**2003**
2	Keyszig E., Advanced Engineering Mathematics, Wiley Eastern Publication	**2006**

REFERENCE BOOKS		
SN	Name of Authors /Books /Publisher	**Year of Pub.**
1	Chandrika Prasad, Mathematics for Engineers, Prasad Mudralaya	
2	Jeffrey, Advanced Engineering Mathematics , ELSEVIER	**2001**
3	Grewal B. S., Higher engineering Mathematics, Khanna Publication, New Delhi	**2000**
4	Peter V. O. Neil, Advanced Engineering mathematics, Thomson Publication	**2011**
5	Gerald, C.F., and Wheatley, P.O., Applied Numerical Analysis, Addison Wesley.	**1980**
6	Jain, M.K., Iyengar, S.R. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, Wiley Eastern.	**2004**
7	Kandasamy, P., Thilagavathy, K., and Gunavathy, S., Numerical Methods, S Chand and Company.	**1999**
8	J. Douglas Faires, Richard L. Burden, Numerical Methods, Cengage Learning.	**2013**
9	Dr. Gokhroo, Higher Engineering Mathematics III, Unique Books, Ajmer	

3ME7A: MATERIAL SCIENCE AND TESTING LAB.

B.Tech. (Mechanical) 3rd Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	(a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids. (b) Material identification of, say, 50 common items kept in a box.	
2	Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.	
3	Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)	
4	Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.	
5	Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.	
6	To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading	
7	To determine Rockwell/ Vickers/Brinell hardness of a given material	
8	To perform Impact test on a given material and to determine its resilience.	
9	To study and perform Fatigue test on a given material and to determine fatigue strength of the material	
10	To perform Bending test and to determine the Young's Modulus of Elasticity via deflection of beam.	
11	Creep testing on creep testing machine	

REFERENCE BOOKS		
SN	Name of Authors /Books /Publisher	**Year of Pub.**
1	Vander Voort, Metallography: Principles and Practice, McGraw-Hill, 1984	
2	Prabhudev K.H., Handbook of Heat Treatment of Steels, Tata McGraw-Hill, 2000	
3	Suryanarayanan, A.V.K. "Testing of Metalic materials" TataMcGraw Hill,1993	

3ME8A: BASIC MECHANICAL ENGINEERING LAB		
B.Tech. (Mechanical) 3rd Semester		**Max. Marks: 75**
0L+0T+2P		**Exam Hours: 2**
SN	**LABORATORY WORK**	**CONTACT HOURS**
	Exposure to a wide range of applications of mechanical engineering through a variety of activities, including hands-on assembly and disassembly of machines, such as, bicycle, sewing machine, pumps, engines, air-conditioners, machine-tools, amongst others; observational study of complex systems via cut sections, visits, videos and computer simulations; design of simple machines/systems including specifications formulation; visits to industries.	
	Note: Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.	

3ME9A: PRODUCTION PRACTICE-I		
B.Tech. (Mechanical) 3rd Semester		**Max. Marks: 75**
0L+0T+3P		**Exam Hours: 3**
SN	**NAME OF EXPERIMENT**	**CONTACT HOURS**
	Machine Shop	
1	To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.	
2	To perform step turning, knurling and chamfering on lathe machine as per drawing.	
3	To perform taper turning (a) by tailstock offset method as per drawing (b) Using compound rest.	
4	To prepare the job by eccentric turning on lathe machine.	
5	To study shaper machine, its mechanism and calculate quick return ratio. To prepare a job on shaper from given mild steel rod.	
	Foundry Shop	
6	To prepare mould of a given pattern requiring core and to cast it in aluminium.	
7	To perform moisture test and clay content test.	
8	Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).	
9	To perform permeability test	
10	A.F.S. Sieve analysis test.	
	Welding Shop	
11	Hands-on practice on spot welding.	
12	Hands-on practice on submerged arc welding	
13	Hands-on practice on metal inert gas welding (MIG) and tungsten inert gas welding (TIG).	

3ME10A: COMPUTER PROGRAMMING LAB.		
B.Tech. (Mechanical) 3rd Semester		**Max. Marks: 50**
0L+0T+2P		**Exam Hours: 2**
SN	**LABORATORY WORK**	**CONTACT HOURS**
	List of Programs in C++	
1	Program using basic I/O and control statements.	

2	Program using class, objects, objects as function parameters.	
3	Program using functions and passing reference to a function, inline functions. Program using	
4	Inheritance and virtual base class.	
5	Program using pointers, arrays, dynamic arrays. Program using functions defined in ctype.h and string.h.	
6	Program using constructors, destructors. Program using function and operator over Loading	
	List of program in C++ implementing Data Structures.	
7	Creating and managing (add, delete, print, insert) nodes of a Linked list	
8	Creating and managing (create, pop, push etc.) stacks and queues.	
	Note: Students should submit and present a minor project at the end of the lab.	

3ME11A: MECHANICAL ENGINEERING DRAWING

B.Tech. (Mechanical) 3rd semester **Max. Marks: 75**
0L+0T+3P **Exam Hours: 3**

SN	CONTENTS	CONTACT HOURS
	Review of sectioning, Review of BIS Standard (SP 46), Fasteners – screws, bolts and nuts, riveted joints, pins, locking devices, welded joints, pipe joints, unions and valves. Assemblies involving machine elements like shafts, couplings, bearing, pulleys, gears, belts, brackets. Tool drawings including jigs and fixtures. Engine mechanisms-assembly and disassembly. Production drawings - limits, fits and tolerances, dimensional and geometric tolerances, surface finish symbols. Layout drawings. Schematics, process and instrumentation diagrams, piping drawings. Structural drawings - examples for reading and interpretation. Computer aided design and use of software packages for engineering drawings	
	Assembly Drawing with sectioning and bill of materials Universal Coupling, Forming punch and die, Jigs for inspecting shaft etc.(1 drawing sheet of any assembly) Lathe tail stock, shaper tool head, steam stop valve, feed check-valve, swivel machine vice etc (1 drawing sheet of any assembly)	
	Detailed part drawings from assembly drawing indicating fits, tolerances and surface finish symbols by referring BIS codes (1 drawing sheet) Check-valve, Junction Valve etc.	
	Computer Aided Drafting (4 drawings) Introduction, input, output devices, introduction to software like AutoCAD/ProE/ Creo/Solidworks, basic commands and development of 2D and 3D drawings of simple parts	
	Free Hand Sketches: Connecting rod, crank shaft, Pipes and Pipe fittings, machine arbor and cutter, universal dividing head, jigs and fixtures, Step less drive, sliding gear box, safety valve, three way stop valve, blow-off cock, Swivel bearing, Turret Tool Post, drill-press vice, screw jack	

TEXT BOOK		
1	Laxminarayan and M.L. Mathur,Machine Drawing ,Jain Brothers	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Gill P S, Machine Drawing, Kataria & Sons	**2009**
2	Basudeb Bhattacharya, Machine Drawing, Oxford University Press	**2011**
3	Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996.	**1998**

4	Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995.	**1995**
5	Siddeshswar N., P Kannaiah, VVS Shastry, Machine Drawing,Tata McGraw Hill	

4ME1A: KINEMATICS OF MACHINES

B.Tech. (Mechanical) 4th semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Kinematics:** Elements, pairs , mechanisms, four bar chain and its inversions,	**3**
	velocity and acceleration, Klein's construction, coriolis component, instantaneous center method	**5**
II	Synthesis of mechanisms, pantograph, scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms	**5**
	Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hooke's joint.	**3**
III	**Power transmission:** Belts and ropes, effect of centrifugal force, creep, chain drive	**4**
	Friction: Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane and screw jack, pivots and friction axis, bearing, Theory of film lubrication.	**4**
IV	**Brakes:** Band, block and band & block brakes, braking action, braking system of automobiles. **Clutches**	**6**
	Dynamometers: absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers	**2**
V	**Cams:** Type of cams, displacement, velocity and acceleration curves for different cam followers consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.	**8**
	TOTAL	**40**

TEXT BOOK		
1	Rattan, S.S., "Theory of Machines", 2nd Ed., Tata McGraw Hill	2006
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Bevan, T., "Theory of Machines", Pearson Education.	2013
2	Uicker, J.J., Pennocle, G.R, and Shigley, J.E, "Theory of Machines and Mechanisms", 3rd Ed., Oxford University Press.	2009
3	Ambekar , A. G., "Mechanism And Machine Theory", Prentice-hall Of India	2007
4	Ghosh, A., "Theory of Mechanisms and Machines", Affiliated East West Press.	
5	Singh, S., "Theory of Machines", Pearson Education	2013

4ME2A: FLUID MECHANICS & MACHINES

B.Tech. (Mechanical) 4th Semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Fluid Properties**: Definition of a fluid, Viscosity-dynamic and kinematic, Surface Tension.	**3**
	Fluid Statics: Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force,	**5**

	Stability of floating and submerged bodies.	
II	**Fluid flow concepts and Basic control volume equations**: General control equation, conservation of mass, energy equation and its application, Momentum equation and its applications	**4**
	Basic governing differential equation: Reynolds transport equation, continuity equation, momentum equation, energy equation, Bernoulli's equation.	**4**
III	**Viscous flow:** Laminar flow through pipe and between parallel plate.	**4**
	Turbulent flow: Relation, Prandle mixing length, Losses in open and closed conduit	**4**
IV	Measurements:Pressure, velocity, flow measurement-orifices, venturimenter, orificemeter, nozzle meter, notches and weirs.	**3**
	Flow through pipe: Major and minor Losses in pipe, Hydraulic and energy gradient line, Network of pipes-series and parallel.	**5**
V	**Hydraulic Turbines:** Classification of hydraulic turbines, work done and efficiencies of Pelton, Francis and Kaplan turbines, Draft tube, Specific speed and unit quantities	**5**
	Hydraulic systems: Hydraulic press, Hydraulic accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque convertor Gear pump.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Yunus A. Cengel and Cimbala, Fluid Mechanics, Tata McGrawHill,	**2006**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Streeter V.L., K.W. Bedford and E.B.Wylie , Fluid Mechanics , Tata McGraw Hill	**2010**
2	Robert W. Fox and Alan T. McDonald, Introduction to Fluid Mechanics, John Wiley & Sons.	**2009**
3	Potter, Mechanics of Fluids, Cengage Learning.	**2012**
4	Frank M. White, Fluid Mechanics, Tata McGraw Hill.	**2003**
5	John F. Douglas, Fluid Mechanics, Pearson Education.	**2007**
6	Munson, B. R., Young, D. F., & Okiishi, T. H. Fundamentals of Fluid Mechanics, Wiley	
7	Som, S. K., & Biswas, G. Introduction to fluid mechanics and fluid machines, Tata McGraw Hill.	**2010**
8	K.Subramaanya, Hydraulic Machines, McGrawhill,	**2013**
9	Modi and Seth, Fluid Mechanics and Hydraulic Machinery, Standard Book House	**1991**

4ME3A: MACHINING AND MACHINE TOOLS

B.Tech. (Mechanical) 4th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Classification of metal removal process and machines: Concept of generatrix and directrix Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship. Concept of orthogonal and oblique cutting.	**4**
	Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Various theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting. Introduction to tool geometry of milling	**4**

	cutters and drills.	
II	Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Measurement and control of tool wear, Concept of tool life,	**4**
	Taylor's tool life equation (including modified version). Different tool materials and their applications including effect of tool coating. Introduction to economics of machining. Cutting fluids: Types, properties, selection and application methods	**4**
III	Basic machine tools: Constructional configuration, specifications and estimation of machining time on lathe, drilling, shaping, milling, grinding and broaching machine.	**4**
	Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations.	**4**
IV	Introduction to Grinding-Need and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications, mounting and dressing. Surface finishing: Honing, lapping, super-finishing, polishing and buffing.	**6**
	Thread Manufacturing: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling and thread grinding.	**3**
V	Gear Manufacturing Processes: hot rolling; stamping; powder metallurgy; extruding etc. Gear generating processes: gear hobbling, gear shaping. Gear finishing processes: shaving, grinding, lapping, shot blasting, phosphate coating, Gear testing.	**4**
	High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Rao. P.N., Manufacturing Technology, Vol. 1,2 and 3, Tata McGraw Hill	**2013**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Lal G.K., Introduction to Machining Science, New Age international Publishers.	**2007**
2	Ghosh, A., & Mallik, A. K. 1986. Manufacturing Science: East West Press Private Limited.	**1999**
3	Schey, Introduction to Manufacturing Processes, Tata McGraw Hill	**2000**
4	Kalpakjian, S., & Schmid, S. R., Manufacturing processes for engineering materials, Pearson Education.	**2008**
5	Pandey & Singh, Production Engineering Science, Standard Publishers Distributer, Delhi.	**1999**
6	Stephenson, D. A., & Agapiou, J. S. Metal cutting theory and practice: CRC Taylor & Francis.	**2006**
7	Karl H.Heller, All About Machine Tools, Wiley Eastern Ltd., New Delhi	**1972**
8	Kalpakjian, S. & Schmid S.R, Manufacturing Engineering and Technology, Addison Wesley Pub. Co.	**2000**
9	Sen, G. C., & Bhattacharyya, A. Principles of Machine Tools: New Central Book Agency	**1988**
10	Bhattacharyya A, Theory & Practice of Metal Cutting, New Central Book Agency	**2006**
11	Shan, H.S., Manufacturing Process, Pearson Education.	**2012**
12	Boothroyd, G., & Knight, W. A. Fundamentals of machining and machine tools: Taylor and Francis.	**2006**
13	Milton C. Shaw, Metal Cutting Principles, CBS Publishers.	**2005**

14	Trent, E. M. Metal cutting: Butterworth Heinemann	**2000**

4ME4A: DESIGN OF MACHINE ELEMENTS – I

B.Tech. (Mechanical) 4th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Materials**: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.	3
	Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly.	4
II	**Design for Strength**: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.	4
	Design of Members subjected to direct stress: pin, cotter and keyed joints.	5
III	**Design of Members in Bending**: Beams, levers and laminated springs. **Design for stiffness of beam:** Use of maximum deflection formula for various end conditions for beam design	7
IV	**Design of Members in Torsion** **Shaft and Keys:** Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys.	5
	Couplings*:* Design of muff coupling, flanged couplings: rigid and flexible	3
V	**Design of Threaded fasteners**: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading	4
	Power screws like lead screw, screw jack	2
	Design of members which are curved like crane hook, body of C-clamp, machine frame etc.	3
	TOTAL	**40**

TEXT BOOK		
1	Bhandari, V. B., Introduction to Machine Design, McGraw Hill Education (India)	**2013**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Bahl and Goel, Mechanical Machine Design, Standard Publishers Distributors	**2002**
2	Shigley, Joseph E., Mechanical Engineering Design, McGraw Hill Education (India)	**2002**
3	Sharma and Aggarwal, Machine Design, S.K.Kataria and Sons, Delhi.	**1997**
4	Sharma and Purohit, Design of Machine Elements, Prentice Hall India.	**2002**
5	Jindal U C, Machine Design, Pearson Education India	**2010**

4ME5A: INDUSTRIAL ENGINEERING

B.Tech. (Mechanical) 4th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Concept and definition of Industrial Engineering, Historical development of IE, Role of Industrial Engineer, Applications of IE. Concept of Productivity, Work Study and Productivity,	3

	Techniques of work study, basic procedure, approach to method study, method study charts and diagrams, principles of motion economy,	**4**
II	Work measurement; basic procedure, techniques: Stop watch time study and work sampling, rating, determination of standard time	**4**
	Evolution of Management Theory, scientific management, Contributions of Taylor, Fayol, Mayo to scientific management, Levels of Management Administration and Management, fundamental functions of management, Decision making.	**4**
III	Business Forms and Organization: Forms of Business: Single proprietorship, partnership, joint stock company, co-operative society, State undertakings. Formation of Joint Stock Companies: Registration, issue of Prospectus, Commencement Certificate. Organization: meaning, Types of organization; Line, Functional, Line Staff organization and line Staff Committee organization, span of control.	**5**
	Finance & Financial Statements: Introduction, Needs of Finance, Kinds of Capital, Sources of fixed capital, Shares. Borrow capital, surplus profits.	**3**
IV	Sources of working capital and its management, Profit & Loss Statement, Balance Sheet, Financial ratios: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio.	**5**
	Time value of money: Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal life, comparison of deferred investments,	**4**
V	Time value of money II: Future worth comparison, payback period comparison. Rate of return, internal rate of return, comparison of IRR with other methods	**3**
	Depreciation: Causes, Basic methods of computing depreciation charges; Straight line, Sinking fund, Declining Balance and Sum of year's digits method.	**3**
	Breakeven analysis: Basic concepts, Linear Breakeven analysis for single product, Breakeven charts, Dumping.	**2**
	TOTAL	**40**

TEXT BOOK		
1	Motion and Time Study and Measurement of Work, Ralph, M Barnes , John Wiley and Sons.	2001
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Introduction to Work Study, George Kanawaty, ILO.	2002
2	Prasad, L.M., Principles and practice of Management, Sultan Chand & Sons.	
3	Sushil Kumar Basu, K. C. Sahu, N. K. Datta, Works Organisation & Management, Oxford & IBH.	
4	Dexter S. Kimball, Principles of Industrial Organization, Read Books.	
5	Leon Pratt Alford, Henry Russell Beatty, Principles of Industrial Management, Revised Edition, Ronald Press Co.	
6	Essentials of Industrial Management, McGraw-Hill Industrial organization and management series, Lawrence L. Bethel, McGraw-Hill.	
7	Riggs, J.L., Bedworth, D.J., Randhawa, S.U., Engineering Economics, Tata McGraw-Hill.	

4ME6A: I.C. ENGINES

B.Tech. (Mechanical) 4th Semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**History of IC engines**: Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel-air cycles, Actual cycles..	4
	Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	4
II	**Fuel & Combustion:** Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.	4
	Fuel: Conventional Petroleum, structure, Refining Fuels for SI & CI engines, Knock rating, Additives, Fuels for Turbine & Jet Propulsion.	2
	Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.	2
III	**Engine Systems & Components:** Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburettors, types, Aircraft carburettor, comparison of carburetion & injection, F/A ratio calculations.	3
	CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.	2
	Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.	3
IV	**Engine Friction & Lubrication :** Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.	5
	Supercharging: Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.	3
V	**Dual & Multi fuel engines:** Principle, fuels, Combustion, performance Advantages, Modification in fuel system.	4
	Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines.	4
		40

TEXT BOOK		
1	Mathur & Sharma, Internal Combustion Engines, Dhanpat Rai & Sons	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Gupta H.N., Fundamentals of Internal Combustion Engines, Prentice Hall	

	of India	
2	F.Edward Obert, Internal Combustion Engines, Harper and Raw Publisher.	
3	John B. Heyword, Internal Combustion Engines Fundamentals, McGraw Hill	
4	Lichty, Internal Combustion Engines, McGraw Hill.	
5	Gill, Smith, Ziurs, Fundamentals of Internal Combustion Engine, Oxford & IBH Publishing	
6	Rogowsky, IC Engines, International Book Co.	
7	Ganeshan, V., Internal Combustion Engine, Tata Mc Graw Hill.	
8	R. Yadav, I.C Engine, Central Publishing House, Allahabad	

4ME7A: KINEMATICS OF MACHINES LAB

B.Tech. (Mechanical) 4th Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	To study inversions of four bar chain: Coupling Rod, Beam Engine	
2	To study Steering Mechanisms; Davis and Ackerman.	
3	Study of quick return mechanism and draw velocity and acceleration diagram.	
4	Study of inversion of Double slider chain Oldham Coupling, Scotch Yoke and Elliptical Trammel.	
5	Study of various cam-follower arrangements.	
6	To plot displacement v/s angle of rotation curve for various cams	
7	To determine co-efficient of friction using two roller oscillating arrangement.	
8	Study of various types of dynamometers, Brakes and Clutches.	
9	To determine moment of inertia of the given object using of Trifler suspension.	
10	Perform study of the following using Virtual Lab http://www.vlab.co.in/	
11	Position, velocity and acceleration analysis of Grashof four bar mechanism	
12	Position, velocity and acceleration analysis of Slider Crank mechanism	

4ME8A: FLUID MECHANICS LAB

B.Tech. (Mechanical) 4th Semester **Max. Marks: 50**
0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	Determination of Meta-centric height of a given body.	
2	Determination of Cd, Cv & Cc for given orifice.	
3	Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate.	
4	Determination of velocity of water by Pitot tube.	
5	Verification of Bernoulli's theorem.	
6	Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzle meter	
7	Determination of head loss in given length of pipe.	
8	Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.	
9	Determination of Coefficient for minor losses in pipes.	
10	To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.	

11	To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.	

4ME9A: PRODUCTION PRACTICE-II

B.Tech. (Mechanical) 4th semester **Max. Marks: 75**
0L+0T +3P **Exam Hours: 3**

UNIT	NAME OF EXPERIMENT	CONTACT HOURS
1	To study of single point cutting tool geometry and to grind the tool as per given tool geometry.	
2	To study the milling machine, milling cutters, indexing heads and indexing methods and to prepare a gear on milling machine.	
3	To machine a hexagonal / octagonal nut using indexing head on milling machine.	
4	To cut BSW/Metric internal threads on lathe machine.	
5	a) To cut multi-start Square/Metric threads on lathe machine.	
	b) Boring using a boring bar in a centre lathe.	
6	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.	
7	Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.	
8	Grinding of milling cutters and drills.	
9	Exercise on cylindrical and surface grinders to machine surfaces as per drawing.	
10	Cylindrical grinding using grinding attachment in a centre lathe	

4ME10A: MACHINE DESIGN SESSIONAL-I

B.Tech. (Mechanical) 4th Semester **Max. Marks: 75**
0L+0T+3P **Exam Hours: 3**

SN	SESSIONAL WORK	CONTACT HOURS
1	Material selection and relevant BIS nomenclature	
2	Selecting fit and assigning tolerances	
3	Examples of Production considerations	
4	Problems on:	
	(a) Knuckle & Cotter joints	
	(b) Torque: Keyed joints and shaft couplings	
	(c) Design of screw fastening	
	(d) Bending: Beams, Levers etc.	
	(e) Combined stresses: Shafts, brackets, eccentric loading.	

TEXT BOOK	
1. Design Data Book, PSG College of Technology	

4ME11A: THERMAL ENGINEERING LAB-1

B.Tech. (Mechanical) 4th semester **Max. Marks: 75**
0L+0T +2P **Exam Hours: 2**

UNIT	NAME OF EXPERIMENT	CONTACT HOURS
1	Study of working of four stroke petrol engine and four stroke diesel	

	engine with the help of cut section models	
2	Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.	
3	To draw valve timing diagram for a single cylinder diesel engine.	
4	Study of various types of boilers.	
5	Study of various types of mountings and accessories.	
6	Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.	
7	Study of braking system with specific reference to types of braking system, master cylinder, brake shoes.	
8	Study of transmission system including clutches, gear box assembly and differential.	
9	Study of fuel supply system of a petrol engine (fuel pump and simple carburetor)	
10	Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)	
11	Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.	
12	Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication)	
13	Study of cooling systems of an IC Engine (air cooling and water cooling)	

5ME1A: HEAT TRANSFER

B.Tech. (Mechanical) 5th Semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction:** Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient.	**4**
	Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation	**3**
II	**Heat transfer from extended surfaces:** Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions.	**3**
	Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart.	**2**
	Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.	**4**
III	**Natural convection:** Dimensional analysis, Grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations.	**4**
	Heat transfer with change of phase: Nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.	**4**

IV	**Heat exchanger:** Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.	**8**
V	**Thermal Radiation:** Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.	**8**
		40

TEXT BOOK		
1	J.P. Halman, Heat Transfer, Mc Graw Hill	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Incropera and Dewitt, Fundamental of Heat and Mass transfer, John Wiley	**2007**
2	Cengel, Heat and Mass transfer, Mc Graw Hill	**2011**
3	M.Thirumaleshwar, Fundamental of Heat and Mass Transfer, Pearson Education	**2006**
4	Ozisik, Heat and Mass Transfer, Mc Graw Hill	**2009**

5ME2A: DYNAMICS OF MACHINES

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	**Governors:** Comparison between flywheel and governor, Types of governor, Watt, Porter, Proell, Hartnell and spring controlled governors, sensitiveness of governors, stability of governors, isochronous and hunting, governor effort, power, controlling force diagram.	**8**
II	**Gyroscope:** Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on aeroplanes, ships and vehicle taking a turn, stabilization of sea vessels, stability of four wheeled vehicle moving in a curved path, curved path with banking, stability of two wheeled vehicle, gyroscopic effect on inclined rotating disc	**5**
	Inertia force analysis: Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel.	**3**
III	**Gears:** Classification, terminology, law of gearing, velocity of sliding, gear tooth profile, comparison of cycloidal and involute tooth profile, standard interchangeable tooth profile, length of path of contact, arc of contact, contact ratio, interference, undercutting, minimum number of teeth on pinion in contact with gear or rack, bevel, helical and spiral gears.	**9**
IV	**Gear Trains**: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for finding velocity ratio, gear boxes- sliding and constant mesh, synchromesh and differential gear box.	**7**
V	**Balancing:** Need of balancing, Balancing of rotating masses, single plane, different planes, balancing of reciprocating masses, single cylinder engine, multi-cylinder inline engines, V-engines, concept of direct and reverse cranks, partial balancing of locomotives, IC engines, V engines and balancing machines.	**8**
	TOTAL	**40**

TEXT BOOK		
1	Rattan, S.S., "Theory of Machines", 2nd Ed., Tata McGraw Hill.	2006
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Bevan, T., "Theory of Machines", Pearson Education.	2013
2	Uicker, J.J., Pennocle, G.R, and Shigley, J.E, "Theory of Machines and Mechanisms", 3rd Ed., Oxford University Press.	2009
3	Ambekar , A. G., "Mechanism And Machine Theory", Prentice-hall Of India	2007
4	Ghosh, A., "Theory of Mechanisms and Machines", Affiliated East West Press.	
5	Singh, S., "Theory of Machines", Pearson Education	2013

5ME3A: MEASUREMENT & METROLOGY

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Concept of measurement:** General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty.	4
	Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Comparison between systematic error and random error, Correction, Calibration, Interchangeability.	3
II	**Linear and angular measurements:** Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges:- Gauge design, Problems on gauge design, Application of limit gauges;	3
	Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator;	2
	Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor , Autocollimator, Angle dekkor	4
III	**Form measurement:** Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors, Spur gear measurement, Parkinson gear tester, Problems on gear measurement.	4
	Surface finish measurement:-Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements	4
IV	**Laser and advances in metrology:** Laser metrology, Laser telemetric system, Laser and led based distance measuring instruments, pattern formed in a laser, Principle of laser, Interferometry, Use of laser in interferometry, Laser interferometry.	3
	Machine tool metrology: Various geometrical checks on machine tool, Laser equipment for alignment testing, Machine tools tests, Alignment tests on lathe, milling machine, pillar type drilling machine, Acceptance tests for surface grinders, Coordinate measuring machine (CMM):- Types of CMM, Features of CMM, Computer based inspection, Computer aided inspection using robots.	5
V	**Measurement of power, flow and temperature related properties** Measurement of force, Direct methods, Indirect methods:- Accelerometer, Load cells, Bourdon tube. **Torque measurement:** Prony brake, Torque measurement using strain gauges, Torque measurement using torsion bars,	4

	Measurement of power: Mechanical dynamometers, D.C. dynamometer, Eddy current or inductor dynamometers	
	Measurement of flow: Orifice meter, Venturimeter, Flow nozzle, Variable area meters – rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Calibration of temperature measuring devices, Thermocouples (Thermo electric effects), Thermistors, Pyrometers	**4**
	TOTAL	**40**

TEXT BOOK		
1	G.K. Vijayaraghavan & R. Rajappan, Engineering Metrology and Measurements, A.R.S. Publications, Chennai, Fourth Edition June	2009
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Mechanical Measurements , Beckwith T.G. ,N.L. Buck, and R.D. Marangoni , Addison Wesley	
2	Dimensional Metrology . Khare & Vajpayee, Oxford & IBH	
3	Engineering Metrology, Jain R.K., Khanna Publishers	
4	Metrology & Precision Engineering , Scarr, McGraw Hill	
5	Handbook of Industrial Metrology, ASTME	
6		

5ME4A: QUALITY ASSURANCE AND RELIABILITY

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	The meaning of Quality and quality improvement, dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality.	**5**
	Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance.	**4**
II	Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven.	**4**
	Control chart for variables,: X-bar and R charts, X-bar and S charts, control chart for individual measurement. Application of variable control charts.	**4**
III	Control chart for attributes: control chart for fraction non conforming P-chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma.	**7**
IV	Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit.	**2**
	Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ.	**4**
	Introduction to Quality systems like ISO 9000 and ISO 14000.	**2**

V	Reliability and Life Testing- Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability	**4**
	Introduction to Taguchi Method of Design of Experiments, Quality loss function.	**4**
	TOTAL	**40**

TEXT BOOK		
1	Introduction to Statistical Quality Control, Douglas C. Montgomery, 2nd Edition, Wiley.	1991
2	Charles E. Ebeling, An introduction to reliability and maintainability engineering, Tata McGraw-Hill Education.	2004
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Quality Planning and Analysis, J.M.Juran and F.M. Gryna, McGraw Hill	
2	Quality Control, Dale H. Besterfield, 8th Edition, Pearson/Prentice Hall	2008
3	Statistical Quality Control, E. L. Grant and Richard S. Leavenworth, Tata McGraw-Hill	2000
4	Fundamentals of Quality Control and Improvement, Amitava Mitra, 2nd Edition,Prentice Hall	1998
5	Design and Analysis of Experiments, 5th Edition, Douglas C. Montgomery, Wiley-India	2007

5ME5A: SOCIOLOGY AND ELEMENTS OF ECONOMICS FOR ENGINEERS

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power).State & civil society.	**4**
	Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development,	**4**
II	Processes of social exclusion and inclusion, Changing nature of work and organization.	**4**
	Political economy of Indian society. Industrial, Urban, Agrarian and Tribal society; Caste, Class, Ethnicity and Gender; Ecology and Environment.	**5**
III	Basic Principles and Methodology of Economics. Demand/Supply – elasticity –. Theory of the Firm and Market Structure.	**4**
	Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.	**4**
IV	Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank – Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets.	**4**
	Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve	**4**
	Indian economy Brief overview of post independence period – plans.	**4**

V	Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization.	
	Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.	**4**
		40

TEXT BOOK		
1	Mankiw Gregory N., Principles of Economics, Thompson Asia	2002
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Giddens, A, Sociology, Polity, 6th edn.	2009
2	Haralambos M, RM Heald, M Holborn, Sociology, Collins	2000
3	Xaxa, V, State, Society and Tribes Pearson	2008
4	Chandoke, Neera & Praveen Priyadarshi , Contemporary India: Economy, Society and Politics, Pearson	2009
5	Mohanty, M, Class, Caste & Gender- Volume 5, Sage	2004
6	Ramaswamy, E.A. and Ramaswamy,U., Industry and Labour, OU Press	1981
7	Bhowmik, S (ed.) Street Vendors in the Global Urban Economy, Routledge	2010
8	Rao, M.S.A. (ed.) Urban Sociology, Orient Longmans	1974
9	V. Mote, S. Paul, G. Gupta, Managerial Economics, Tata McGraw Hill	2004
10	Misra, S.K. and Puri , Indian Economy, Himalaya	2009
11	Pareek Saroj , Textbook of Business Economics, Sunrise Publishers	2003

5ME6.1A: COMPUTER AIDED DESIGN AND GRAPHICS

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Overview of Computer Graphics:** Picture representation, Coordinate Systems, Raster Scan Display, DDA for line generation and Bresenham's algorithm for line and circle generation; Graphics standards: GKS, IGES, STEP, DXF. Different types of models.	**5**
	Parametric representation of plane curves: line, circle, ellipse, parabola and hyperbola.	**4**
II	**Parametric representation of Space Curves:** Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.	**4**
	Parametric representation of Surfaces: Hermite Bicubic surfaces, Bezier surfaces and Bspline surfaces.	**4**
III	**Solid Representation:** B-rep. and CSG. Comparison between three types of models.	**7**
IV	**Two and Three Dimensional Transformation of Geometric Models:** Translation, Scaling Reflection, Rotation and Shearing, Homogeneous Representation, Combined Transformation.	**4**
	Projection of Geometric models: Parallel and Perspective Projection.	**4**
V	**Clipping:** Point clipping, Line clipping, Cohen- Sutherland algorithm etc., Viewing transformation.	**4**
	Hidden line and surface removal: Techniques and Algorithms. Shading and Rendering.	**4**
	TOTAL	**40**

TEXT BOOK	

1	Zeid and Sivasubramanian,CAD/CAM: Theory and Practice, Tata McGraw Hill	
2	Rogers and Adams, Mathematical Elements for Computer Graphics, Tata McGraw Hill	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Rao P.N., CAD / CAM Principles and Applications, McGraw Hill.	**2004**
2	Pao Y.C., Elements of Computer Aided Design and Manufacturing, John Wiley and Sons.	**1984**
3	Alavala C.R., CAD/CAM: Concepts and Applications, Prentice Hall of India.	**2008**
4	Xiang and Plastock, Computer Graphics, Schaum's Outlines, Tata McGraw Hill.	**2007**

5ME6.2A: AUTOMOBILE ENGINEERING

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Frame & Body:** Layout of chassis, types of chassis frames and bodies, their constructional features and materials.	**3**
	Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. **Brakes:** Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.	**5**
II	**Gear Boxes**: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter;	**4**
	Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive.	**4**
III	**Wheels and Tyres**: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre,	**2**
	Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types	**3**
	Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.	**3**
IV	**Automotive Electrical System:** Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification.	**4**
	Ignition System: Magneto and coil ignition systems, System components and requirements, Automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.	**4**
V	**Automotive Air Conditioning:** Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis.	**4**
	Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning	**4**

	System)	
	TOTAL	**40**

TEXT BOOK		
1	RP SHARMA,A Course in Automobile Engineering,Dhanpat Rai & Sons	
2	P S Gill,A Text book of Automobile Engineering,KATSON Books VOL 1&2	2010
3	Kirpal Singh,Automobile Engineering, Standard	2003
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	R K Rajpoot,A Text book of Automobile Engineering,Laxmi Publications	2007
2	Jornsen Reimpell, Helmut Stoll,The Automotive Chassis: Engineering Principles,Jurgen Betzler (P) Ltd,	2001

5ME6.3A: STATISTICS FOR DECISION MAKING

B.Tech. (Mechanical) 5th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Introduction - Statistical Terminology: Descriptive statistics or exploratory data analysis, inferential statistics, population, sample, variable, parameter, statistic, random sample.	3
	Collecting Data: Historical data, types of studies (comparative, descriptive or noncomparative, observational, experimental), sample surveys, sampling and nonsampling errors, bias, representative sample, judgment sampling, quota sampling, simple random samples, sampling rate, sampling frame, stratified random sampling, multistage cluster sampling, probability-proportional-to-size sampling, systematic sampling.	4
II	Summarizing and Exploring Data: Variable types (categorical, qualitative, nominal, ordinal, numerical, continuous, discrete, interval, ratio), summarizing categorical data (frequency table, bar chart, Pareto chart, pie chart), summarizing numerical data (mean, median), skewness, outliers, measures of dispersion (quantiles, range, variance, standard deviation, interquartile range, coefficient of variation) s tandardized z-scores, histogram, bivariate numerical data (scatter plot, simple correlation coefficient, sample covariance), straight line regression, summarizing time-series data, data smoothing, forecasting techniques.	4
	Basic Concepts of Inference: Estimation, hypothesis testing, point estimation, confidence interval estimation, estimator, estimate, bias and variance of estimator, mean square error, precision and standard error, confidence level and limits, null and alternative hypothesis, type I and II error, probabilities of type I and II error, acceptance sampling, simple and composite hypothesis, P-value, one-sided and two -sided tests.	4
III	Inference for Single Samples: Inference for the mean (large samples), confidence intervals for the mean, test for the mean, sample size determination for the z-interval, one-sided and two -sided z-test, inference for the mean (small samples), t distribution.	4
	Inference for Two Samples: Independent sample design, matched pair design, pros and cons of each design, side by side box plots, comparing means of two populations, large sample confidence interval for the difference of two means, large sample test of hypothesis for the difference of two means, inference for small samples (confidence	4

	intervals and tests of hypothesis).	
IV	Inference for Proportions and Count Data: Large sample confidence interval for proportion, sample size determination for a confidence interval for proportion,	**3**
	Large sample hypothesis test on proportion, comparing two proportions in the independent sample design (confidence interval and test of hypothesis), chi-square statistic	**4**
V	Simple Linear Regression and Correlation: Dependent and independent variables, probability model for simple linear regression, least squares fit, goodness of fit of the LS line, sums of squares, analysis of variance, prediction of future observation, confidence and prediction intervals,	**4**
	Multiple Linear Regression: Probability model for multiple linear regression, least squares fit, sums of squares. Use Excel, R, and MATLAB® in the class.	**4**
	TOTAL	**40**

TEXT BOOK		
1	Ajit Tamhane and Dorothy Dunlop "Statistics and Data Analysis: From Elementary to Intermediate" Prentice Hall	1999
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Richard Ivor Levin, David S. Rubin, Statistics for Managements, Prentice Hall International	1988
2	J. K. Sharma, Statistics for Management, Pearson Education India	

5ME7A: HEAT TRANSFER LAB.

B.Tech. (Mechanical) 5th Semester **Max. Marks: 125**
0L+0T+3P **Exam Hours: 3**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	To Determine Thermal Conductivity of Insulating Powders.	
2	To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).	
3	To determine the transfer Rate and Temperature Distribution for a Pin Fin.	
4	To Measure the Emissivity of the Test plate Surface.	
5	To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.	
6	To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.	
7	Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.	
8	To Determine Critical Heat Flux in Saturated Pool Boiling.	
9	To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.	
10	To Find the Heat transfer Coefficient in Forced Convection in a tube.	
11	To study the rates of heat transfer for different materials and geometries	
12	To understand the importance and validity of engineering assumptions through the lumped heat capacity method.	

5ME8A: DYNAMICS OF MACHINES LAB. – II

B.Tech. (Mechanical) 5th Semester **Max. Marks: 75**

0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	To verify the torque relation for gyroscope.	
2	To plot force vs. radius and lift vs. speed curves for governors.	
3	To plot pressure distribution curves on a journal bearing.	
4	To perform wheel balancing.	
5	To perform static and dynamic balancing on balancing set up.	
6	To determine mass moment of inertia of a flywheel.	
7	Study of a lathe gear box.	
8	Study of a sliding mesh automobile gear box.	
9	Study of a planetary gear box.	

5ME9A: PRODUCTION ENGINEERING LAB.

B.Tech. (Mechanical) 5th Semester **Max. Marks: 100**
0L+0T+3P **Exam Hours: 3**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.	
2	Measurement of angle and width of a V-groove by using bevel protector..	
3	(a) To measure a gap by using slip gauges (b) To compare & access the method of small-bore measurement with the aid of spheres.	
4	Measurement of angle by using sine bar.	
5	(a) Measurement of gear tooth thickness by using gear tooth vernier caliper. (b) To check accuracy of gear profile with the help of profile projector.	
6	To determine the effective diameter of external thread by using three-wire method.	
7	To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.	
8	To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.	
9	Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.	
10	Forces measurements during orthogonal turning.	
11	Torque and Thrust measurement during drilling.	
12	Forces measurement during plain milling operation.	
13	Measurement of Chip tool Interface temperature during turning using thermocouple technique.	

5ME10A: PROFESSIONAL ETHICS AND DISASTER MANAGEMENT

B.Tech. (Mechanical) 5th Semester **Max. Marks: 50**
0L+0T+2P **Exam Hours: 2**

SN	CONTENTS	CONTACT HOURS
1	**Human values:** Effect of Technological Growth and Sustainable Development. Profession and Human Values: Values crisis in contemporary society. Nature of values. Psychological Values, Societal Values and Aesthetic Values. Moral and Ethical values.	
2	**Professional ethics:** Professional and Professionalism-Professional Accountability, Role of a professional, Ethic and image of profession; Engineering Profession and Ethics: Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world; Professional Responsibilities: Collegiality,	

	Loyalty, Confidentially, Conflict of Interest, Whistle Blowing.	
3	**Disaster management:** Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, impact and preventive measures: Natural Disasters- Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions. **Man made Disasters:** Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Case studies. Disaster Management Cycle and its components.	
4	In order to fulfill objectives of course, a) The institute shall be required to organize at least 3 expert lectures by eminent social workers/professional leaders. b) Each student shall compulsorily be required to: i. Visit a social institution/NGO for at least 7 days during the semester and submit a summary report. ii. II. Perform a case study of a disaster that has occurred in last decade and submit a summary report.	

REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Professional Ethics by R Subramanian, oxford publishers	
2	Engineering Ethics: Concepts and cases by Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins. CENGAGE Learning, Delhi	
3	Controlling Technology: Ethics and Responsible Engineers by Stephen H Unger. John Willey and Sons.	
4	Ethical Issues in Engineering, by Deborah Johnson. Prentice Hall	
5	Human Values in the engineering Profession, Moniograph by A N Tripathi. Published by IIM Calcutta.	
6	Towards Basics of Natural Disaster Reduction by Prof. D.K. Sinha. Researchco Book Center, Delhi.	
7	Understanding Earthquake Disasters by Amita Sinvhal. Tata McGraw Hill, New Delhi.	

6ME1A: DESIGN OF MACHINE ELEMENTS- II

B.Tech. (Mechanical) 6th Semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Fatigue Considerations in Design:** Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration.	**3**
	Goodman line, Soderberg line, Design of machine members subjected to combined, steady and alternating stresses.	**3**
	Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses.	**2**
II	**Design of IC Engine components:** Piston, Cylinder, Connecting Rod and Crank Shaft.	**8**
III	Design of helical compression, tension, torsional springs, springs under variable stresses.	**4**
	Design of belt, rope and pulley drive system,	**4**

IV	**Design of gear teeth:** Lewis and Buckingham equations, wear and dynamic load considerations.	**4**
	Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.	**4**
V	**Design of Sliding and Journal Bearing:** Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium.	**4**
	Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication.	**4**
	TOTAL	**40**

TEXT BOOK		
1	Design of Machine Elements, Bhandari V.B, 3rd Ed., Tata McGraw-Hill, New Delhi	2010
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Machine Design, Sharma and Aggarwal, Kataria and Sons, Delhi.	**1997**
2	Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill	**2002**
3	PSG Design Data Book, P.S.G. College of Technology, Coimbatore.	**1966**
4	A Text Book of Machine Design, Karwa A., Laxmi Publication.	**2002**
5	Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.	

6ME2A: NEWER MACHINING METHODS

B.Tech. (Mechanical) 6th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.	**3**
	Abrasive finishing processes: AFM, MAF (for Plain and cylindrical surfaces).	**4**
II	**Mechanical advanced machining process**: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC.	**6**
III	**Thermo electric advanced machining process**: Introduction, Principle, process parameters,advantages, disadvantages and applications about EDM, EDG,	**4**
	LBM, PAM, EBM	**6**
IV	**Electrochemical and chemical advanced machining process**: ECM, ECG, ESD, Chemical machining,	**5**
	Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process.	**3**
V	Intorduction to Micro and nanomachining, Nanoscale Cutting, Diamond Tools in Micromachining, Conventional Processes: Microturning, Microdrilling and Micromilling, Microgrinding,	**5**
	Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry.	**4**
	TOTAL	**40**

TEXT BOOK		
1	Modern Machining Process, Pandey and Shan, Tata McGraw Hill	1980
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Advance Machining Process, Jain V.K., Allied Publishers Ltd.	2002
2	Non Traditional Manufacturing Process, Gary F. Bevedict, Marcel Dekker Inc New York.	1987
3	Non-Conventional Machining Process, Mishra P.K., Narosa Publishing House	2006
4	Non-Conventional Machining Process, J.A. McGeough	1988
5	Nano and Micromachining, J. Paulo Davim, and Mark J. Jackson, Wiley-ISTE	2008

6ME3A: MECHATRONICS

B.Tech. (Mechanical) 6th Semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction:** Introduction, scope and applications of Mechatronics systems. Process control automation, FMS and CNC Machines.	5
	MEMS: Basics of Micro- and Nanotechnology, microprocessor-based controllers and Microelectronics	3
II	**Introduction to Sensors:** Linear and Rotational Sensors, Acceleration, Force, Torque, Power, Flow and Temperature Sensors, Light Detection, Image, and Vision Systems, Integrated Micro-sensors,	4
	Introduction to Actuators: Electro-mechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro-transducers Analysis, Design and Fabrication.	4
III	**Systems and Controls:** The Role of Controls in Mechatronics, Role of Modelling in Mechatronics Design, Signals and Systems: Continuous- and Discrete-time Signals, Z-Transforms and Digital Systems, Continuous- and Discrete-time State-space Models.	5
	Advanced Control Systems: Digital Signal Processing for Mechatronics Applications, Control System Design, Adaptive and Nonlinear Control Design, Neural Networks and Fuzzy Systems, Design Optimization of Mechatronics Systems.	3
IV	**Data Acquisition and related Instrumentation:** Introduction to Data Acquisition Measurement Techniques: Sensors and Transducers, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, Signal Conditioning.	4
	Real time Instrumentation: Computer-Based Instrumentation Systems, Software Design and Development, Data Recording and Logging.	4
V	**Design of Mechatronics systems:** Introduction of mechatronics systems: Home appliances, ABS (anti-lock braking system) and other areas in automotive engineering, Elevators and escalators, Mobile robots and manipulator arms, Sorting and packaging systems in production lines, Computer Numerically Control (CNC) production machines, Aeroplanes and helicopters, Tank fluid level and temperature control systems.	8
	TOTAL	40
TEXT BOOK		
1	Bolton, W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson Education	2011

REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Mechatronics, HMT Hand Book, Tata McGraw Hill	**2000**
2	Alciatore and Histand, "Introduction to Mechatronics and Measurement Systems", Tata McGraw Hill	**2011**
3	Smaili and Mrad, "Mechatronics: Integrated Technologies for Intelligent Machines", Oxford	**2008**
4	Mahalik N.P., "Mechatronics: Principles, Concepts and applications", Tata McGraw Hill.	**2003**

6ME4A: VIBRATION ENGINEERING

B.Tech. (Mechanical) 6th semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Sound:** Frequency dependent human response to sound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level.	**2**
	Introduction to Noise: Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies.	**3**
	Introduction to Vibration: Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition.	**3**
II	**Undamped Single Degree of Freedom System:** Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion.	**3**
	Damped vibrations of single degree of freedom systems: Viscous damping, under-damped, critically damped and over-damped systems, Logarithmic decrement.	**3**
	Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems.	**2**
III	**Forced Vibrations of Single Degree of Freedom Systems:** Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support.	**4**
	Vibration Isolation and Transmissibility: Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation.	**4**
IV	**System with Two Degrees of Freedom:** principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped dynamic vibration absorber and centrifugal pendulum absorber	**5**
	Critical Speed of Shaft: Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed.	**3**
V	**Many Degrees of Freedom Systems (Exact analysis)**: Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling **Many Degrees of Freedom Systems (approximate methods**): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods	**5**

	Vibrations of continuous systems: Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Rao S.S., "Mechanical Vibrations", Pearson Education, 2nd Indian reprint.	2004
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Ambekar A.G., "Mechanical Vibrations and Noise Engineering", Prentice-Hall of India Pvt. Ltd.	2006
2	Kelly, S.G., "Mechanical Vibrations, Theory and Applications, Cengage Learning	2013
3	Thomson, W.T., and Dahleh, M.D., Padmanabhan, C., "Theory of Vibrations with Applications", Pearson Education.	2014
4	Meirovitch, L., "Elements of Vibration Analysis", Tata McGraw-Hill	2006
5	Tongue, B.H., "Principles of Vibration", Oxford Publication	2007

6ME5A: STEAM ENGINEERING

B.Tech. (Mechanical) 6th Semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Steam generators:** Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pr. Boilers, Natural and forced circulation boilers, Water wall.	**4**
	Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers	**4**
II	Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser.	**8**
III	**Steam Turbines:** Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview and difference of various type of turbine, different types of governing of turbines.	**3**
	Impulse turbine: The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads	**5**
IV	**Impulse reaction turbine:** Velocity diagram and work done , degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine.	**5**
	Regenerative Feed Heating Cycles: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. direct contact and surface heaters.	**4**
V	**Reheating of steam**: Practical reheating and Non- reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle,	**4**

	regenerative water extraction cycles.	
	Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers.	**3**
		40

TEXT BOOK		
1	Steam, Gas Turbine and Power Plant Engineering, Yadav R., CPH Allahabad	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	A Practical Guide to Steam Turbine, Heinz P. Bloch, McGraw Hill Publication	**1995**
2	Steam Turbines: Design Application and Rerating, Heinz P. Bloch, McGraw Hill Publication.	**1996**
3	Steam Turbine: Theory and Design, Shlykhin P., University press of Pacific.	**2006**
4	Steam Turbine: Theory and Construction, Wilde and Salter, Merchant Books.	**2007**
5	Power Plant Engineering, Nag P.K., Tata McGraw-Hill, New Delhi.	**1992**
6	Thermal Science & Engineering, Kumar D.S., S.K.Kataria & Sons	**2006**
7	Engineering Thermodynamics, Nag P.K., Tata McGraw-Hill, New Delhi	**1998**
8	Fundamentals of Classical Thermodynamics, Gordan J Van Wylen, Willey Eastern Ltd.	**1959**
9	Engineering Thermodynamics, Cengel & Boles, Tata McGraw-Hill, New Delhi.	**2006**
10	Engineering Thermodynamics, Chottopadhyay P., Oxford University Press.	2009

6ME6.1A: NON DESTRUCTIVE EVALUATION AND TESTING

B.Tech. (Mechanical) 6th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction**: An Overview, Factors influencing the Reliability of NDE, Defects in materials, Defects in composites. NDT methods used for evaluation of materials and composites.	**3**
	Visual Inspection: Basic Principle and Applications.	**2**
	Liquid Penetrant Testing: Principle, Procedure and Test Parameters, Materials, Limitations and Applications.	**3**
II	**Radiographic Inspection:** Principles of X – ray radiography, equipment, Absorption, Scattering, X-ray film processing, General radiographic procedures, Reading and Interpretation of Radiographs, Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography.	**8**
III	**Ultrasonic Testing:** Principle of wave propagation, Ultrasonic equipment, Variables affecting an ultrasound test, Basic methods: Pulse Echo and Through Transmission, Types of scanning.	**5**
	Applications of UT: Testing of products, Welding Inspection, Tube Inspection, Thickness Measurement, Elastic Constant Determination, Ultrasonic testing of composites.	**3**
IV	**Magnetic Particle Inspection:** Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure, Interpretation and evaluation.	**5**
	Introduction to Accostic Emission Testing and Thermography.	**3**
V	**Eddy Current Testing:** Principle of eddy current, Factors affecting eddy currents, Test system and test arrangement, Standardization and	**5**

	calibration, Application and effectiveness.	
	Comparison and Selection of NDT Methods, Codes and Standards	**3**
	TOTAL	**40**

TEXT BOOK		
1	Baldev Raj, T. Jay Kumar, M. Thavasimuthu, Practical Non-Destructive Testing, Narosa.	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Loius Cartz, Non Destructive Testing, ASM International	**1995**
2	J PRASAD, C G K NAIR, NDT & Evaluation Of Materials, Tata McGraw Hill	**2008**
3	R. Halmshaw, Introduction to the Non-Destructive Testing of Welded Joints,	**1997**
4	American Metals Society, Non-Destructive Examination and Quality Control, Metals Hand Book, Vol.17, 9th Ed.	**1989**

6ME6.2A: DESIGN AND MANUFACTURING OF PLASTIC PRODUCTS

B.Tech. (Mechanical) 6th semester **Max. Marks: 100**

3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Plastics Materials: An Overview, Classification, Thermoplastics, Thermosets, Crystalline, Amorphous, and Liquid, Crystalline Polymers, Copolymers, Alloys, Elastomers, Additives, Reinforcements, and Fillers, Physical Properties and Terminology.	**5**
	Mechanical Properties, Thermal Properties, Electrical Properties, Environmental Considerations.	**3**
II	**Design Considerations for Injection-Molded Parts**: Injection Molding Process, Design Strategy, Efficient and Functional Design, Material Selection,	**2**
	Nominal Wall Thickness, Normal Ranges of Wall Thickness, Structural Requirements of the Nominal Wall,	**2**
	Insulation Characteristics of the Nominal Wall, Impact Response of the Nominal Wall, Draft, Structural Reinforcement, Ribs, Other Geometric Reinforcement, Bosses, Coring, Fillets and Radii, Undercuts	**4**
III	Polymer processing techniques such as extrusion, compression and transfer moulding.	**4**
	Injection moulding, blow moulding, thermoforming, rotational moulding, calendaring.	**4**
IV	Assembly: General Types of Assembly Systems, Molded-In Assembly Systems, Snap-Fit Assembly, Molded-In Threads, Press-Fits, Chemical Bonding Systems, Solvent Welding, Adhesive Bonding, Thermal Welding Methods.	**4**
	Spin Welding, Radio Frequency (RF) Welding, Electromagnetic or Induction Welding, Assembly with Fasteners, Bolted Assembly, Threaded Metal Inserts, Self-Tapping Screws, Riveted Assembly, Sheet Metal Nuts, Specialty Plastic Fasteners	**4**
V	Machining of Plastics: Drilling and Reaming,Thread Tapping, Sawing, Milling, Turning, Grinding.	**4**
	Finishing and Decorating of Plastics: Painting, Vacuum Metallizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping	**4**
	TOTAL	**40**

TEXT BOOK		
1	Design and Manufacture of Plastic Parts, R.L.E. Brown, John Wiley and Sons, New York	1980
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Designing with Plastics, Gerhard, Hanser Verlag	
2	Handbook of Plastics Joining: a practical guide, PDL handbook series, Plastics Design Library, William Andrew	
3	Modern Plastics Handbook, McGraw Hill handbooks, Modern plastics series, Charles A. Harper, McGraw-Hill Professional	1997
4	Industrial Plastics: theory and applications, Erik Lokensgard and Terry L. Richardson, 4th Edition, Cengage Learning	2000

6ME6.3A: MAINTENANCE MANAGEMENT

B.Tech. (Mechanical) 6th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Introduction -Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc.	3
	Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.	4
II	Maintenance Management - types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations.	4
	Computer aided maintenance, maintenance scheduling, spare part management, inventory control, organisation of maintenance department.	4
III	Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes.	3
	Lubricants - types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings.	3
	Repair methods for basic machine elements: Repair methods for beds, slideways, spindles, gears, lead screws and bearings–Failure analysis–Failures and their development–Logical fault location methods–Sequential fault location.	3
IV	Machine Health Monitoring - Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques,	4
	Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.	4
V	Reliability, availability & maintainability (RAM) Analysis - Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems.	4
	Improvement in reliability, reliability testing, reliability prediction, utilisation factor, system reliability by Monte Carlo Simulation Technique.	4
	TOTAL	**40**

TEXT BOOK		
1	Anthony Kelly, Strategic Maintenance Planning, Butterworth-Heinemann	2006
2	R. C. Mishra, K. Pathak ,Maintenance Engineering and Management, PHI Learning Pvt. Ltd	2012
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill	1988
2	Maintenance & Spare parts Management Gopal Krishnan	
3	Srivastava S.K., "Industrial Maintenance Management", S. Chand and Co	1981
4	Hand book of Condition Monitoring CNR Rao	
5	White E.N., "Maintenance Planning", I Documentation, Gower Press	1979
6	Armstrong, "Condition Monitoring", BSIRSA	1988
7	Davies, "Handbook of Condition Monitoring", Chapman &Hall,	1996

6ME7A: MACHINE DESIGN SESSIONAL-II

B.Tech. (Mechanical) 6th Semester **Max. Marks: 125**
0L+0T+3P **Exam Hours: 3**

SN	SESSIONAL WORK	CONTACT HOURS
	Problems on:	
1	Fatigue loading.	
2	Helical compression, tension and torsional springs design.	
3	Curved Beams.	
4	Preloaded bolts and bolts subjected to variable stresses.	
5	Belt, Rope and Chain drive system.	
6	Gear Design.	
7	Sliding contact bearing design.	
8	Anti-friction bearing selection	

6ME8A: INDUSTRIAL ENGINEERING LAB-I

B.Tech. (Mechanical) 6th Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	SESSIONAL WORK	CONTACT HOURS
1	Case study on X bar charts and process capability analysis	
2	P Chart: (a)Verify the Binomial Distribution of the number of defective balls by treating the balls with a red colour to be defective. (b) Plot a P-chart by taking a sample of n=20 and establish control limits	
3	To plot C-chart using given experimental setup	
4	Operating Characteristics Curve: (a) Plot the operating characteristics curve for single sampling attribute plan for n = 20 ; c = 1 , 2 , 3 Designate the red ball to defective. (b) Compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution	
5	Distribution Verification: (a) Verification of Normal Distribution. (b) To find the distribution of numbered cardboard chips by random drawing one at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in	

	each case. Comment on your observations	
6	Verification of Poisson distribution	
7	Central Limit Theorem: (a) To show that a sample means for a normal universe follow a normal distribution (b) To show that the sample means for a non normal universe also follow a normal Distribution.	
8	Solve problems using available Statistical Process Control software in lab	

6ME9A: MECHATRONICS LAB

B.Tech. (Mechanical) 6th Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	SESSIONAL WORK	CONTACT HOURS
Perform any ten experiments from the list given below		
1	Study the following devices (a) Analog & digital multimeter (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations)	
2	Displacement Measurement using Capacitive & inductive Pick –ups.	
3	Study of Speed Measurement System: (a) Magnetic Pick-up (b) Stroboscope	
4	Study of Load Measurement System Load Cell	
5	Measurement of temperature using thermocouple, thermistor and RTD	
6	Measurement of displacement using POT, LVDT & Capacitive transducer	
7	Torque measurement using torque measuring devices	
8	Strain Measurement using strain gauge	
9	Frequency to Voltage Converter and vice versa	
10	Position and velocity measurement using encoders	
11	Study on the application of data acquisition system for industrial purposes	
12	Speed control of DC motor using PLC.	
13	Study of Load Measurement System Load Cell	

6ME10A: VIBRATION ENGINEERING LAB.

B.Tech. (Mechanical) 7th Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	To verify relation $T = 2\pi\sqrt{(l/g)}$ for a simple pendulum.	
2	To determine radius of gyration of compound pendulum.	
3	To determine the radius of gyration of given bar by using bifilar suspension.	
4	To determine natural frequency of a spring mass system.	
5	Equivalent spring mass system.	
6	To determine natural frequency of free torsional vibrations of single rotor system. i. Horizontal rotor ii. Vertical rotor	
7	To verify the Dunkerley's rule.	
8	Performing the experiment to find out damping co-efficient in case of free damped torsional vibration	
9	To conduct experiment of trifler suspension.	
10	Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.	

11	Study of Vibration measuring instruments.	
12	Perform study of the following using Virtual Lab http://www.vlab.co.in/	
13	Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural frequency and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.	
14	Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at different damping ratio and frequency ratio.	
15	Perform study of the following using Virtual Lab http://www.vlab.co.in/	
16	Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural frequency and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.	
17	Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at different damping ratio and frequency ratio.	

7ME1A: FINITE ELEMENT METHODS

B.Tech. (Mechanical) 7th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to FEM and its applicability, Review of :Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth.	**4**
	Structure analysis: Two-force member element, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix	**4**
II	One-dimensional Finite Element Analysis: Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations using potential energy approach for linear and quadratic 1-D bar element,	**5**
	shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.	**3**
III	Two Dimensional Finite Element Analysis: Finite element formulation using three nodded triangular (CST) element , Plane stress and Plain strain problems,	**4**
	Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements,	**2**
	Numerical integration using gauss quadrature formula, computation of stress and strain.	**2**
IV	Finite Element Formulation from Governing Differential Equation: Method of Weighted Residuals, Collocation, Sub domain method, Least Square method and Galerkin's method,	**5**
	Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variational formulation (Ritz Method.)	**3**
V	Higher Order Elements: Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape,	**5**
	Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix in dynamic analysis.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Seshu P.,"Text Book of Finite Element Analysis", Prentice Hall India	2003
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Dixit, U. S., "Finite Element Methods for Engineers" Cengage Learning	2003
2	Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.	2001
3	An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi	1993
4	Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.	2007
5	Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.	1999

7ME2A: REFRIGERATION AND AIR CONDITIONING

B.Tech. (Mechanical) 7th Semester **Max. Marks: 100**

3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction:** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System:** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions	5
	Multiple Evaporator and compressor system: Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.	3
II	**Gas Cycle Refrigeration:** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger.	4
	Air cycle for air craft: Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.	4
III	**Other refrigeration systems** (description only): Vapour absorption refrigeration system, Electrolux refrigerator, Lithium Bromide - Water system, Water vapour refrigeration system, Vortex tube refrigeration system, thermo electric refrigeration system.	4
	Refrigerants: Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. Refrigeration Equipments: Compressor, condenser, evaporator, expansion devices, types & working.	4
IV	**Psychrometry:** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor, Apparatus Dew point temperature and air washers.	5
	Human Comfort: Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.	3
V	**Cooling load calculations:** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling.	5
	Selection of air conditioning: Apparatus for cooling and dehumidification, Air conditioning system, year round air conditioning.	3
	TOTAL	**40**

TEXT BOOK		
1	Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw Hill	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Stoecker W.F., "Refrigeration & Air Conditioning" McGraw Hill Publication.	**2000**
2	Andrew D. Althouse., "Modern Refrigeration & Air Conditioning" GoodHeart-Willcox Co.	**2002**
3	Jorden & Priester, Refrigeration & Air Conditioning, Prentice Hall of India.	**2003**
4	Roy J. Dossat, Principal of Refrigeration, Pearson Education, New Delhi.	**2014**
5	Edward G. Pita, Air Conditioning Principles and Systems, Pearson Education, New Delhi.	**2003**
6	Jain V.K., Refrigeration & Air Conditioning, Tata McGraw Hill New Delhi.	2004

7ME3A: OPERATIONS RESEARCH

B.Tech. (Mechanical) 7th semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Overview of Operations Research**	**1**
	Linear Programming: Applications and model formulation, Graphical method, Simplex method, duality and Sensitivity analysis.	**4**
	Transportation Model and Assignment Model including travelling salesman problem.	**4**
II	**Integer Linear Programming:** Enumeration and cutting Plane solution concept, Gomory's all integer cutting plane method, Branch and Bound Algorithms, applications of zero-one integer programming.	**5**
	Replacement Models: Capital equipment replacement with time, group replacement of items subjected to total failure.	**3**
III	**Queuing Theory**: Analysis of the following queues with Poisson pattern of arrival and exponentially distributed service times, Single channel queue with infinite customer population, Multichannel queue with infinite customer population,	**3**
	Competitive Situations and Solutions: Game theory, two person zero sum game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy, approximate solution, and simplified analysis for other competitive situations. Application of linear programming	**4**
IV	Theory of Decision making: Decision making under certainty, risk and uncertainty. Decision trees.	**5**
	Deterministic Inventory control models: functional role of inventory, inventory costs, model building, Single item inventory control model without shortages, with shortage and quantity discount. Inventory control model with uncertain demand, service level, safety stock, P and Q systems, two bin system. Single period model. Selective Inventory control techniques.	**4**
V	**Probabilistic Inventory control models:** Instantanoues demand without setup cost and with setup cost, Continuous demand without setup cost	**4**
	Simulation: Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of Normal Random numbers. Use of random numbers for	**4**

	system simulation. , Monte Carlo simulation, simulation language ARENA, Application of simulation for solving queuing Inventory Maintenance, Scheduling and other industrial problems	
	TOTAL	**40**

TEXT BOOK		
1	Operations Research, Ravindran, Phillips and Solberg, Wiley India.	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Introduction to Operations Research, Hillier F.S. and Lieberman G.J., CBS Publishers.	
2	Operations Research, Taha H.A., Pearson Education	
3	Linear Programming and Network Flows, Bazaraa, Jarvis and Sherali, Wiley India.	
4	Principles of Operations Research, Wagner H.M., Prentice Hall of India.	
5	Operations Research, Gupta and Heera, S. Chand Publications.	

7ME4A: TURBOMACHINES

B.Tech. (Mechanical) 7th Semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Basic Concepts of Turbo Machines:** Definition & classification of Turbo machine, Basic laws and governing equations: continuity equation, steady flow energy equation(1st law of thermodynamics),2nd law of thermodynamics applied to turbo machines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation	**4**
	Dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed, Range of specific speeds for various turbo machines, Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate parameter and speed parameter	**4**
II	**Centrifugal Compressors and Fans:** Components and description, velocity iagrams, slip factor, energy transfer, power input factor, stage pressure rise and loading coefficient, pressure coefficient, degree of reaction, Centrifugal compressor characteristic, surging, rotating Stall and Choking	**3**
	Axial Flow Compressors and Fans: Basic constructional features, Advantages of axial flow compressors, working principle, velocity triangle, elementary theory, stage work, work done factor, stage loading, degree of reaction; vortex theory, simple design calculations, introduction to blade design, cascade test, compressibility effects, operating characteristics	**3**
	Reciprocating Compressors: Basic constructional features, working principle, work done calculation, single and double acting compressors	**2**
III	**Centrifugal Pumps:** Main parts, work done and velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting speed, net positive suction head, performance curve.	**3**
	Axial Flow Pumps: Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation.	**3**
	Reciprocating Pumps: Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip, effect of friction and	**2**

	acceleration, theory of air vessels.	
IV	**Gas power cycles**: Ideal and practical gas turbine cycle, heat exchange cycle, reheat cycle, intercooled cycle, Comparison of various cycles.	**4**
	Thermodynamic Cycles: Advantages, disadvantages and performance characteristics of Ram jet engine, pulse jet engine, turbo prop engine, turbo jet engine, turbo fan engine, Calculation of specific thrust and efficiency	**4**
V	**Gas Turbines:** impulse and reaction type gas turbines, Velocity triangles and calculation of work done, efficiency etc.	**8**
	TOTAL	**40**

TEXT BOOK		
1	Gas turbines, V. Ganesan, Tata McGraw-Hill	
2	Subramanya, K., Hydraulic Machine, Tata McGraw Hill	2013
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Principle of Turbo Machinery, Turton R.K., Springer Publication	**1994**
2	Fundamentals of Turbo Machinery, William W., John Wiley and Sons.	**2008**
3	Turbo Machinery Basic Theory and Application, Logan E.J.	**1981**
4	Principles of Turbo Machinery, Shepherd Dennis G., Mac Millan Publisher, New York.	1956
5	TurboMachines, A Valan Arasu, Vikas Publishing House Pvt. Ltd.	**2009**
7	Gas turbine theory, Cohen and Saravanamutto, Pearson Educational Publication	**2009**
8	Hydraulic Machine: Turbines and Pumps, Nazarov N.T., Springer New York.	**2003**
9	Gas Turbine Theory, Cohen and Roger, Pearson Education.	
10	Hydraulic Machinery, Jagdish Lal, Metropolitan Books.	

7ME5A: OPERATIONS MANAGEMENT

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to operations management (OM), the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity	**3**
	Demand Forecasting: components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique.	**4**
II	Product and Service design, Process selection, Process types, Product and process matrix, Process analysis.	**3**
	Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.	**2**
III	Facility Location: Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; Designing product and process layout, line balancing. Material Handling	**4**
	Planning levels: long range, Intermediate range and Short range	**4**

	planning, Aggregate planning: Objective, Strategies, and techniques of aggregate planning. Master scheduling; Bill of materials, MRP; inputs processing and outputs, and overview of MRPII , use of MRP to assist in planning capacity requirements, Introduction to ERP	
IV	Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules, sequencing jobs through two work centers, scheduling services	**4**
	Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system	**4**
V	Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management.	**3**
	Project Management: Nature of projects, project life cycle, Work breakdown structure, PERT and CPM, Time-Cost trade-offs: Crashing. Resource allocation, leveling	**5**
	TOTAL	**40**

TEXT BOOK		
1	Stevenson, Operations Management, Tata McGraw Hill.	2009
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Roberta S. Russell, Bernard W. Taylor, Operations Management, John Wiley & Sons	2010
2	Joseph S. Martinich, Production And Operations Management, John Wiley & Sons	2008
3	S.N. Chary, Production and Operations Management, Tata McGraw Hill	2009
4	Norman Gaither, Greg Frazier, Operations Management, Thomson Learning	2002
5		

7ME6.1A MICRO AND NANO MANUFACTURING

B.Tech. (Mechanical) 7th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Nanoscale Cutting:- Introduction, Material representation and microstructure, Atomic interaction; Nonomachining:- Introduction, Nanometric machining, Theoretical basis of machining;	**4**
	Meso-micromcahining:- Introduction, size effects in micromachining, mechanism for large plastic flow, origin of the size effect, Meso-machining processes. Product quality in micromachining, Burr formation in micromachining operations.	**4**
II	Microturning:- Characteristic features and applications, Microturning tools and tooling systems, Machine tools for microturning	**2**
	Microdrilling: Characteristic features and applications, Microdrills and tooling systems, Machine tools for microdrilling Micromilling:- Characteristic features and applications, Micromills and	**2**

	tooling systems, Machine tools for micromilling,	
	Micro machining high aspect ratio microstructures, micromolding, micromolding processes, micromolding tools, micromold design, micromolding applications, limitations of micromolding.	**3**
III	**Microgrinding and Ultra-precision Processes:** Introduction, Micro and nanogrinding, Nanogrinding apparatus, Nanogrinding procedures, Nanogrinding tools, Preparation of nanogrinding wheels, Bonding systems, Vitrified bonding	**4**
	Non-Conventional Processes: Laser Micromachining:- Introduction, Fundamentals of lasers, Stimulated emission, Types of lasers, Laser microfabrication, Nanosecond pulse microfabrication, Shielding gas, Effects of nanosecond pulsed microfabrication, Picosecond pulse microfabrication, Femtosecond pulse microfabrication, Laser nanofabrication.	**4**
IV	**Diamond Tools in Micromachining:** Introduction, Diamond technology, Hot Filament CVD (HFCVD), Preparation of substrate, Selection of substrate material, Pre-treatment of substrate, Modified HFCVD process.	**4**
	Deposition on complex substrates, Diamond deposition on metallic (molybdenum) wire, Deposition on WC-Co microtools, Diamond deposition on tungsten carbide, (WC-Co) microtool, Performance of diamond-coated microtool	**4**
V	**Evaluation of Subsurface Damage in Nano and Micromachining:** Introduction, Destructive evaluation technologies, Cross-sectional microscopy, Preferential etching, Angle lapping/angle polishing, X-ray diffraction, Micro-Raman spectroscopy.	**4**
	Applications of Nano and Micromachining in Industry: Introduction, Typical machining methods, Diamond turning, Shaper/planner machining, Applications in optical manufacturing, Aspheric lens, Fresnel lens, Microstructured components, Semiconductor wafer production.	**5**
	TOTAL	**40**

TEXT BOOK		
1	Micro and Nano manufacturing by Marks J. Jackson springer	2008
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	J. Paulo Davim, Mark J. Jackson, Nano and Micromachining ISTE Ltd John Wiley & Sons, Inc.	2009

7ME6.2A: ROBOTICS

B.Tech. (Mechanical) 7th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Robotics:** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots.	**3**
	Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.	**5**
II	**Robot End Effectors:** Classification of end effectors, drive system for grippers, Mechanical, Magnetic, Vaccum, Adhesive grippers, Hooks,	**4**

	Scoops, Miscellaneous devices, Gripper force analysis and Design, Active and Passive Gripeers	
	Coordinate Frames, Mapping and Transforms: Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.	**4**
III	**Symbolic Modeling of Robots:** Direct Kinematic Model, Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator,	**3**
	Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model, Solvability of Inverse Kinematics model, Solution techniques.	**5**
IV	**Robotic Sensors:** The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Choosing the right sensors	**3**
	Robotic vision: Introduction to Robotic Vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Image Representation and Image Processing	**5**
V	**Robot Applications:** Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications.	**4**
	Robot Programming: Robot languages, Classification of Robot language, Computer control and robot software, VAL system and language	**4**
	TOTAL	**40**

TEXT BOOK		
1	Mittal R.K., Nagarath, I.K., Robotics and Control, Tata Mc Graw Hill,	**2007**
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Deb S.R., Robotics Technology and Flexible Automation, Tata McGraw Hill	**2010**
2	Ghoshal, A., Robotics Fundamental Concepts and Analysis, Oxford University Press	**2010**
3	Craig JJ, Introduction to Robotics, Mechanics and Control, Addison-Wesley, 2nd Ed.	**2004**
4	Fu, K.S., Gonzales, R.C. and Lee, C.S.G., Robotics: Control, Sensing, Vision and Intelligence, McGraw Hill	**1987**
5	Groover, M. P., Wiess, M., Nagel, R. N. and Odery, N. G. Industrial Robotics- Technology, Programming and Applications, McGraw Hill Inc. Singapore	**2000**
9		

7ME6.3A: CNC MACHINES AND PROGRAMMING

B.Tech. (Mechanical) 7th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	Introduction: Definition of NC, Applications of NC ,Historical Developments in Automation, Classification of NC Systems, Comparison of NC and Conventional Machines, Advantages of NC	**8**
II	NC Hardware: Architecture of NC Systems, Design Considerations, Mechanical Elements, Structure, Guideways and Slides, Guideway Elements, Transmission Systems, Spindle Unit, Coolant system, Lubrication System, Tool and work Changing Mechanisms, Electrical	**8**

	Elements, Drives, Sensors, Control Loops, Computing Elements/ Firmware, Interpolators	
III	NC Software: Introduction, Manual Part Programming, Computer-Assisted Part Programming, Language Based , Geometric Modeling Based, Automatic Part Program Generation,	**8**
IV	CAPP Systems , 5 Axis Programming, Post-Processing, Programming Robots and CMMs	**4**
	NC Simulation, Kinematic simulation, Volumetric simulation, Applications of Volumetric NC Simulation, Verification	**4**
V	Advanced Topics:, Adaptive Control, Off-line adaptive control, Various optimisation criteria, Hardware Based AC, Software Based AC, Tooling and Instruments for NC Special Considerations in High Speed Cutting (HSC) and Die Sinking, Rapid Product Development, CAM, FMS, CIM	**8**
	TOTAL	**40**

TEXT BOOK		
1	Krar S. and Gill A., CNC: Technology and Programming, McGraw Hill	1990
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Koren Y., Computer Control of Manufacturing Systems, Tata McGraw Hill.	1983
2	Pressman R.S. and Williams J.E., Numerical Control and Computer-Aided Manufacturing, John Wiley & Sons	1977,
3	Jones B.L., Introduction to Computer Numerical Control, John Wiley & Sons.	1986
4	Kral I.H., , Numerical Control Programming in APT, Prentice-Hall	1986
5	Chang C.H. and Melkanoff M.A., ,NC Machine Programming and Software Design, Prentice-Hall	1986

7ME7A: THERMAL ENGINEERING LAB-II

B.Tech. (Mechanical) 7th Semester **Max. Marks: 100**
0L+0T+3P **Exam Hours: 3**

SN	**LABORATORY WORK/NAME OF EXPERIMENT**	**CONTACT HOURS**
1	To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power, and heat balance sheet.	
2	To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine. (Morse Test)	
3	Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.	
4	To study refrigeration cycle, determination of coefficient of performance of cycle and tonnage capacity of refrigeration unit.	
5	To determine the COP and tonnage capacity of a Mechanical heat pump.	
6	To study various controls used in Refrigeration and Air conditioning system.	
7	Determination of dryness fraction of steam.	
8	Study and Performance of Simple Steam Turbine	
9	Performance characteristics of Pelton wheel turbine.	
10	Performance characteristics of Francis turbine.	
11	Performance characteristics of Kaplan turbine.	
12	Performance characteristics of variable speed centrifugal pump.	
13	Performance characteristics of rated speed centrifugal pump.	

7ME8A: FINITE ELEMENT LAB.

B.Tech. (Mechanical) 7th Semester **Max. Marks: 100**
0L+0T+3P **Exam Hours: 3**

SN	LABORATORY WORK/NAME OF EXPERIMENT	CONTACT HOURS
1	Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems **A: by using FE packages such as NASTRAN/ ANSYS/ SIMULIA/ ABAQUS**	
2	Introduction of GUI of the software in the above mentioned areas realistic problems.	
3	Analysis of beams and frames (bending and torsion problems)	
4	Plane stress and plane strain analysis problems	
5	Problems leading to analysis of axisymmetric solids	
6	Problems leading to analysis of three dimensional solids (a) Heat transfer problems (b) Modal analysis problem	
	B: by writing own code for finite element analysis using MATLAB for:	
7	Plane stress and plane strain analysis problems	
8	Modal Analysis problem	

8ME1A: COMPUTER INTEGRATED MANUFACTURING SYSTEMS

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to CIM:** Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background,	2
	Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system.	3
II	NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification.	8
III	Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards.	4
	Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.	4
IV	Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control.	6
	Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing.	2
V	Computer Aided Material Handling; Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.	

	Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS).	**5**
	Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.	**3**
	TOTAL	**40**

TEXT BOOK		
1	Mikell P. Groover, , Automation, Production Systems, and Computer-Integrated Manufacturing, 3rd ed., Pearson/Prentice Hall,	2008
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	James A. Rehg and Henry W. Kraebber, 2005, Computer-Integrated Manufacturing, 3rd ed., Pearson/Prentice Hall,	
2	Nanua Singh, 1996, Systems Approach to Computer-Integrated Design and Manufacturing, John Willey & Sons.	
3	Computer Aided Manufacturing, Chang, Wysk and Wang, Pearson Education	
4	CAD/CAM: Principles and Applications, P.N. Rao, McGraw Hill	
5	Computer Control of Manufacturing Systems,Y. Koren, McGraw Hill	
6	Computer aided Manufacturing, Rao, Tiwari and Kundra, Tata McGraw Hill.	
7	Computer Numerical Control: Machining and Turning Centres, Quesada and Jeyepoovan, Pearson Education	

8ME2A: LAWS FOR ENGINEERS

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
	Constitutional Law*:* The Preamble; Fundamental Rights; Directive principles of State policy; Fundamental Duties; Emergency provisions – kinds, legal requirements and legal effects.	**5**
I	**General Principles of Contract under Indian Contract Act, 1872:** General principles of contract – Sec. 1 to 75 of Indian Contract Act and including Government as contracting party, Kinds of government contracts and dispute settlement, Standard form contracts; nature, advantages, unilateral character, principles of protection against possibility of exploitation, judicial approach to such contracts, exemption clauses, clash between two standard form contracts.	**4**
II	**Introduction to Human Rights:** Theoretical foundation, Historical development of human rights; Human Rights in Indian tradition and Western tradition; Covenant on Civil & Political Rights 1966 including Optional Protocol – I (Individual Complaint Mechanism) & Optional Protocol – II (Abolition of Death Penalty); Covenant on Economic, Social and Cultural Rights 1966 including Optional Protocol – I (2002);	**4**
	Enforcement of Human Rights in India including Supreme Court, High Courts, Statutory Commissions – NHRC, NCW, NCM, NC-SC/ST etc.	**4**
	Labour Laws: Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen"s Compensation Act, 1923.	**3**
III	**Right to Information Act, 2005:** Evolution and concept; Practice and procedures; Official Secret Act, 1923; Indian Evidence Act, 1872;	**3**

	Information Technology – legislation and procedures, Cyber crimes – issues and investigations.	
	Law relating to Intellectual property: Introduction–meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; International instruments on IP – Berne convention, Rome convention, TRIPS, Paris convention and international organizations relating IPRs, WTO etc;	**4**
IV	Law relating to Copyright in India, Meaning of copyright – literary, dramatics and musical works, sound records and cinematographic films, computer programs, Ownership of copyrights, Criteria of infringement, Piracy in Internet – Remedies and procedures in India;	**1**
	Law relating to Trademarks under Trademark Act, 1999 including Rationale of protection of trademarks as Commercial aspect and Consumer rights, Trademarks, registration, procedures, Distinction between trademark and property mark, Doctrine of deceptive similarity, Passing off an infringement and remedies;	**2**
	Law relating to Patents under Patents Act, 1970, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent –application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.	**3**
V	**Corporate Law**: Meaning of corporation; Law relating to companies, public and private (Companies Act, 1956) general provisions; Law and multinational companies – International norms for control, FEMA 1999, Corporate liability, civil and criminal.	**4**
	Election provisions under Indian Constitution (Art.324–329): Representation of Peoples Act and Prevention of Corruption Act, 1988; Superintendence, directions and control of elections to be vested in Election Commission; Election to the house of people and to the legislative assemblies of States to be on the basis of adult suffrage. Candidate electoral rights.	**3**
	TOTAL	**40**

REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	D.D. Basu, Shorter Constitution of India, Prentice Hall of India	1996
2	M.P. Jain, Indian Constitutional Law, Wadhwa & Co.	2005
3	S.K. Awasthi & R.P. Kataria, Law relating to Protection of Human Rights, Orient Publishing	2006
4	S.K. Kapur, Human Rights under International Law and Indian Law, Central Law Agency	2001
5	Avtarsingh, Law of Contract, Eastern Book Co	2002
6	Wadhera , Intellectual Property Rights, Universal Law Publishing Co	2004
7	T. Ramappa, Intellectual Property Rights Law in India, Asia Law House	2010
8	O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers	

8ME3A: POWER GENERATION

B.Tech. (Mechanical) 8th Semester **Max. Marks: 100**
3L+1T **Exam Hours: 3**

UNIT	**CONTENTS**	**CONTACT HOURS**
I	**Introduction to economics of power generation:** Load duration	**7**

	curves, location of power plants, power plant economics.	
II	**Analysis of Steam Power Plants (SPP):** Components of steam power plants, Effect of variations, variation of steam condition on thermal efficiency of steam power plant. Typical layout of SPP. Efficiencies in a SPP.	**9**
III	**Analysis of Hydroelectric Power Plants (HEPP):** Components of HEPP, Typical layout of HEPP, Performance of turbines and comparison.	**4**
	Analysis of Diesel and Gas Turbine Power Plants: General layout of Diesel and Gas Turbine power plants, Performance of Diesel and Gas Turbine power plants, comparison with other types of power plants.	**4**
IV	**Wind Energy:** Wind energy potential measurement, general theories of wind machines, basic laws and concepts of aerodynamics, aerofoil design; wind mill and wind electric generator. Description and performance of the horizontal–axis wind machines. Description and performance of the vertical–axis wind machines. The generation of electricity by wind machines,	**8**
V	**Solar radiation:** its measurement and prediction. Flat plate collectors, liquid and air type. Theory of flat plate collectors, advanced collectors, optical design of concentrators, selective coatings, solar water heating, thermal storage. Conversion of heat into mechanical energy. Solar cells, photovoltaic effect, performance of a solar cell, P-V material, performance of solar cells, P-V modules. Solar P-V plants, Economies of solar photovoltaic's.	**8**
		40

TEXT BOOK		
1	P.K.Nag, Power Plant Engineering, Tata McGraw Hill	2008
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Hau E., Wind Turbines: Fundamentals, Technologies, Application and Economics, Springer	**2000**
2	Mathew S.,Wind Energy: Fundamentals, Resource Analysis and Economic s, Springer	2006
3	Burton T. Sharpe D. Jenkins N. and Bossanyi E.,Wind Energy Handbook, John Wiley	2001
4	Jiandong T. (et al.) , Mini Hydropower, John Wiley	
5	Duffie J. A. and Beckman W. A. ,Solar Engineering of Thermal Processes, John Wiley	1997
6	Goswami D. Y. Kreith F. and Kreider J. F. Principles of Solar Engineering, Taylor and Francis	2006
7	Garg H. P. and Prakash S.Solar Energy: Fundamental and Application, Ta ta McGraw Hill	1999
8	Green M.,Third Generation Photovoltaics: Advance Solar Energy, Springer	1997
9	Tiwari G. N.,Solar Energy: Fundamentals, Design, Modeling and Applicati ons, Narosa	2005
10	Johnson G. L.Wind Energy Systems (Electronic Edition), Prentice Hall	2002
11	Wagner H. and Mathur J. Introduction to Hydro energy Systems : Basics, Technology and Operation, Springer	2006
12	Nayak J. K. and Sukhatme S.P. Solar Energy: Principles of Thermal Colle ction and Storage, Tata McGraw Hill	2011
13	Solanki C. S. Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India	2006
14	F.T.Morse, D.Van.Nostran, Power Plant Engineering, Newyork,	2009
15	Johnson G. L.Wind Energy Systems (Electronic Edition), Prentice Hall	1953

16	Wagner H. and Mathur J. Introduction to Hydro energy Systems : Basics, Technology and Operation, Springer	2006
17	M.M.EI- Wakil, Power Plant Technology, McGraw Hill	1984

8ME4.1A: PRODUCT DEVELOPMENT AND LAUNCHING

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Importance of New Product:** Definition-importance-Development Process, Importance of new product for growth of enterprise, Definition of product and new product,	**2**
	Responsibility for new product development, Demands on product development team, Classification of products from new product development point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products,	**3**
	New product development process and organization, Generic product development process for Market Pull Products, Modification of this process for other types of products.	**3**
II	**Need Analysis:** Problem Formulation Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification.	**8**
III	**Generation of Alternatives and Concept Selection:** Concept generation- a creative process, Creativity, Road Elects to creative thinking-Fear of criticism and Psychological set,	**4**
	Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process, Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.	**4**
IV	**Preliminary and Detailed Design:** Design Review Preliminary design-Identification of subsystems, Subsystem specifications, Compatibility, Detailed design of subsystems, component design,	**6**
	Preparation of assembly drawings, Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.	**2**
V	**Management of New Product:** Development and Launch New Product Management's Challenges, Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention, Design Team Staffing and Organization, Setting key mile stone, Identification of Risk Areas, Project Execution and Evaluation Product Launch Strategies,	**8**
	TOTAL	**40**

TEXT BOOK		
1	Product Design and Manufacturing, Chitale and Gupta. McGraw Hill.	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Product Design and Development, Ulrich and Eppinger, McGraw Hill	**2003**
2	Project Management in New Product Development, Barkley B.T., Tata McGraw Hill.	**2008**
3	Product Management, Anandan C., McGraw Hill.	**2009**
4	Engineering Design Methods, Cross, Nigel, John Wiley and Sons.	**1995**
5	Product Design and Manufacture, Lindbeck, J.R., Prentice Hall of India.	**1995**

8ME4.2: COMPUTATIONAL FLUID DYNAMICS

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Computational Fluid Dynamics and Principles of Conservation**: Conservation of mass, linear momentum: Navier-Stokes equation, Conservation of Energy, General scalar transport equation, Reynolds transport theorem,	4
	Classification of Partial Differential Equations and Physical Behaviour: Elliptic, parabolic and hyperbolic partial differential equations	2
	Approximate Solutions of Differential Equations: Error Minimization Principles, Approximate solutions of differential equations, variational approach, Weighted residual approach: trial function and weighting function, Essential and natural boundary conditions, Least square method, Galerkin's method, Rayleigh-Ritz method	4
II	**Fundamentals of Discretization:** Pre-processing, Solution, Post-processing, Finite Element Method, Finite difference method, Well posed boundary value problem, Conservativeness, Boundedness, Transportiveness, Finite volume method (FVM), 1-D steady state heat conduction without and with constant source term	3
	Finite Volume Method: FV Discretization of a 1-D steady state diffusion type problem, Composite material with position dependent thermal conductivity, Source term linearization, Implementation of boundary conditions, 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme	4
III	**Solution of Systems of Linear Algebraic Equations:** Solution techniques for systems of linear algebraic equations: Elimination, Iteration and Gradient Search method, L-U decomposition technique, Tridiagonal matrix algorithm (TDMA): Thomas algorithm	4
	Iteration methods: Generalized analysis of the iterative methods, Sufficient condition for convergence, Scarborough criteria of for convergence Relaxation methods, Preferential characteristics of iterative methods, Multigrid method, Line by line TDMA, Alternating direction implicit method, Gradient search methods: Steepest descent method, Conjugate gradient method	4
IV	**Discretization of Convection-Diffusion Equations: A Finite Volume Approach:** Central difference scheme, Upwind scheme, Exponential scheme and Hybrid scheme, Power law scheme, Generalized convection-diffusion formulation, The concept of false diffusion, QUICK scheme.	5
	Discretization of Navier Stokes Equations: Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid, SIMPLE Algorithm, SIMPLER Algorithm	3
V	**Introduction to Turbulence Modeling:** Vorticity transport equation, Homogeneous turbulence and isotropic turbulence, Reynolds average Navier stokes (RANS) equation, Necessity of turbulence modeling, Turbulence model: Eddy viscosity, Mixing length, The κ-ε model, RNG κ-ε model, κ-ω model, Reynolds stress model (RSM),Large eddy Simulation (LES),Direct numerical simulation (DNS)	4
	The basic structure of a CFD code: Pre-processor, Solver and Post-processor, User-defined-subroutines, Solution to some basic problems in heat transfer and fluid flow	3
	TOTAL	**40**

TEXT BOOK	

1	Computational Fluid Dynamics, John Anderson, McGraw Hill Publication	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Computational Fluid Dynamics, Jiynan Tu, Butter Worth Henman.	**1998**
2	Computational Fluid and Heat Transfer, Anderson & Tannehill, Taylor & Francis Publication.	**1997**
3	Computational Methods for Fluid Dynamics, Joel H. Ferziger, Springer Publication.	**2009**
4	Computational Heat Transfer, Jaluria Y., Taylor and Francis Publication.	**1996**
5	Computational Heat Transfer and Fluid Flow, Murlidhar and T. Sunder Rajan, Narosa Publications	**2011**

8ME4.3A: TOTAL QUALITY MANAGEMENT

B.Tech. (Mechanical) 8th semester **Max. Marks: 100**
3L+0T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to TQM: Definition, Basic approach, Guru's of TQM, TQM framework, benefits.	**2**
	Leadership: Characteristics of Quality Leadership, Leadership Concepts, The 7 Habits of Highly Effective People, The Deming Philosophy, The Role of TQM Leaders, Quality Council, Core Values, Concepts, and Framework, Quality Statements, Strategic Planning Communications, Decision Making.	**3**
	Customer Satisfaction: Introduction, Customer Perception of Quality, Feedback, Using Customer Complaints, Service Quality, Translating Needs into Requirements, Customer Retention.	**3**
II	Continuous Process Improvement: Introduction, Process, The Juran Trilogy, Improvement Strategies, Types of Problems PDSA Cycle, Problem-Solving Method, DMAIC, Kaizen, Reengineering.	**3**
	Supplier Partnership: Principles of Customer/Supplier Relationship Partnering, Sourcing Supplier, Selection ,Supplier Certification Supplier Rating, Relationship Development.	**2**
	Performance Measures: Basic Concepts, Strategy, performance measure presentation, Cost of Quality, Malcolm Baldrige and Rajiv Gandhi National Quality Award, Balanced Score Card	**3**
III	Lean Enterprise: Historical Review, Lean Fundamentals, Value Stream Map, Implementing Lean, Benefits.	**3**
	Six Sigma: Statistical Aspects, Improvement Methodology, Organizational Structure Benefits.	**3**
	Benchmarking: Benchmarking Defined, Reasons to Benchmark, Process, deciding what to benchmark, Pitfalls and Criticisms.	**2**
IV	Quality Management Systems: Benefits of ISO Registration, ISO Series of Standards, Sector-specific Standards, ISO 9001 Requirements, Implementation, Documentation, Writing the Documents, Internal Audits, Registration.	**2**
	Environmental Management Systems: ISO 14000 Series Standards, Concepts of ISO 14001, ISO 14001, Requirements, Benefits, Integrating QMS and EMS. Other EMS Systems, Relationship to Health and Safety	**2**
	Quality Function Deployment: The QFD Team, Benefits, the voice of the Customer, Organization of Information, House of Quality, Building a House of Quality, QFD Process.	**2**
	Total Productive Maintenance: The Plan, Learning the New Philosophy, Promoting the Philosophy, Training, Improvement Needs, Goal,	**2**

	Developing Plans, Autonomous Work Groups	
V	Management Tools: Forced Field Analysis, Nominal Group Technique, Affinity Diagram, Interrelationship Digraph, Tree Diagram, Matrix Diagram, Prioritization Matrices, Process Decision Program Chart, Activity Network Diagram	2
	Experimental Design: Introduction, Basic Statistics, Hypothesis, t Test F Test. One Factor at a Time Orthogonal Design, Point and Interval Estimate, Two Factors Full Factorials.	3
	Taguchi's Quality Engineering: Introduction, Loss Function, Orthogonal Arrays, Signal-to-Noise Ratio, Parameter Design, Tolerance Design, Case study	3
	TOTAL	**40**

TEXT BOOK		
1	D. H. Besterfield, G. H Besterfield, Hemant Urdhwareshe, Total Quality Management: Revised Third Edition, Pearson Higher Education	2013
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Total Quality Management: text with cases, John S Oakland, Butterworth-Heinemann	2003
2	Total Quality Management for Engineers, Zaire, M., Wood Head Publishing Ltd.	1991
3	Total Quality Control, Feigenbaum. Armand V., McGraw Hill	1991
4	The Management and Control of Quality,(5th Edition), James R.Evans and William M.Lidsay, South-Western (Thomson Learning)	2002
5		

8ME5A: CAM LAB.

B.Tech. (Mechanical) 8th Semester **Max. Marks: 75**
0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	To prepare part programming for plain turning operation.	
2	To prepare part programming for turning operation in absolute mode.	
3	To prepare part program in inch mode for plain turning operation.	
4	To prepare part program for taper turning operation.	
5	To prepare part program for turning operations using turning cycle.	
6	To prepare part program for threading operation.	
7	To prepare part program for slot milling operation.	
8	To prepare part program for gear cutting operation.	
9	To prepare part program for gear cutting using mill cycle.	
10	To prepare part program for drilling operation.	
11	To prepare part program for multiple drilling operation in Z-axis.	
12	To prepare part program for multiple drilling in X-axis.	
13	To prepare part program for multiple drilling in X and Z axis using drilling cycle.	

8ME6A: CAD LAB.

B.Tech. (Mechanical) 8th Semester **Max. Marks: 100**
0L+0T+3P **Exam Hours: 3**

SN	NAME OF EXPERIMENT	CONTACT

		HOURS
1	Introduction and different features of the CAD Software.	
2	2-D Drafting.	
3	3-D Modeling.	
4	3-D Advanced Modeling.	
5	Assembly modeling.	
6	Feature Modification and Manipulation	
7	Detailing.	
8	Sheet Metal Operations.	
9	Surface Modeling	
10	One Dimensional problems of Finite Element Method Note: (These exercises may be performed by any of the following Advanced CAD Software such as Pro E /Unigraphics/ AotoCAD Inventor)	

8ME7A: INDUSTRIAL ENGINEERING LAB-II

B.Tech. (Mechanical) 8th Semester **Max. Marks: 75**

0L+0T+2P **Exam Hours: 2**

SN	NAME OF EXPERIMENT	CONTACT HOURS
1	Determination of time standard for a given job using stopwatch time-study.	
2	Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.	
3	Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.	
4	To carry out a work sampling study.	
5	To conduct process capability study for a machine in the workshop.	
6	To design a sampling scheme based on OC curve.	
7	To conduct Shewart's experiments on known population	
8	Generation of random numbers for system simulation such as facility planning, job shop scheduling etc.	