ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

CURRICULUM – R 2009

B.E. (PART TIME) MECHANICAL ENGINEERING

SEMESTER I

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTMA9111	Applied Mathematics	3	0	0	3
2	PTPH9111	Applied Physics	3	0	0	3
3	PTCY9111	Applied Chemistry	3	0	0	3
4	PTGE9151	Engineering Mechanics	3	0	0	3
5	PTEC9161	Electronics Engineering	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTMA9212	Transforms and Partial Differential Equations	3	0	0	3
2	PTGE9261	Environment Science & Engineering	3	0	0	3
3	PTME9201	Manufacturing Technology – I	3	0	0	3
4	PTEE9211	Electrical Drives & Control	3	0	0	3
5	PTME9303	Hydraulics and Pneumatics	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER III

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTME9251	Manufacturing Technology – II	3	0	0	3
2	PTCE9213	Strength of Materials	3	0	0	3
3	PTME9202	Engineering Thermodynamics	3	0	0	3
4	PTME9252	Engineering Materials & Metallurgy	3	0	0	3
5	PTME9203	Kinematics of Machines	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER IV

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTME9304	Modern Machining Processes	3	0	0	3
2	PTME9305	Design of Machine Elements	3	0	0	3
3	PTME9253	Dynamics of Machines	3	0	0	3
4	PTME9254	Thermal Engineering – I	3	0	0	3
PRACTICAL						
5	PTME9308	Thermal Engineering Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTME9301	Design of Jigs, Fixtures & Press Tools	3	0	0	3
2	PTME9302	Thermal Engineering – II	3	0	0	3
3	PTME9402	Mechatronics	3	0	0	3
4	PTME9353	Design of Transmission Systems	3	0	0	3
5	PTME9306	Metrology & Measurements	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER VI

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTME9354	Computer Aided Design & Manufacture	3	0	0	3
2	PTME9355	Heat and Mass Transfer	3	0	0	3
3		Elective – I	3	0	0	3
4		Elective – II	3	0	0	3
PRACTICAL						
5	PTME9357	CAD / CAM Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VII

SL No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTGE9022	Total Quality Management	3	0	0	3
2	PTME9401	Power Plant Engineering	3	0	0	3
3		Elective – III	3	0	0	3
4		Elective – IV	3	0	0	3
PRACTICAL						
5	PTME9451	Project Work	0	0	6	6
		TOTAL	**12**	**0**	**6**	**18**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 106

ELECTIVES

SL NO	CODE NO	COURSE TITLE	L	T	P	C
1	PTME9021	Energy Conservation & Management	3	0	0	3
2	PTME9022	New and Renewable Sources of Energy	3	0	0	3
3	PTME9023	Advanced Welding and Casting Processes	3	0	0	3
4	PTME9024	Mechanical Vibrations & Noise	3	0	0	3
5	PTME9025	Design for Manufacturing	3	0	0	3
6	PTME9026	Gas Dynamics and Jet Propulsion	3	0	0	3
7	PTME9027	Management Sciences	3	0	0	3
8	PTME9028	Composite Materials & Mechanics	3	0	0	3
9	PTME9029	Automobile Engineering	3	0	0	3
10	PTME9030	Industrial Tribology	3	0	0	3
11	PTME9031	Turbo Machinery	3	0	0	3
12	PTME9032	Computational Fluid Dynamics	3	0	0	3
13	PTME9033	Micro Electro Mechanical Systems	3	0	0	3
14	PTME9035	Measurements and control	3	0	0	3
15	PTME9036	Advanced IC Engines	3	0	0	3
16	PTME9037	Refrigeration and Air-conditioning	3	0	0	3
17	PTME9038	Nuclear Engineering	3	0	0	3
18	PTME9039	Design of Heat Exchangers	3	0	0	3
19	PTGE9021	Professional Ethics in Engineering	3	0	0	3
20	PTGE9023	Fundamentals of Nanoscience	3	0	0	3
21	PTMF9302	Theory of Metal Forming	3	0	0	3
22	PTME9042	Flexible Manufacturing Systems	3	0	0	3
23	PTMG9072	Entrepreneurship Development	3	0	0	3
24	PTMG9073	Marketing Management	3	0	0	3
25	PTML9402	Non Destructive Materials Evaluation	3	0	0	3
26	PTIE 9023	Product Design and Development	3	0	0	3
27	PTME9351	Finite Element Analysis	3	0	0	3
28	PTMG9362	Industrial Management	3	0	0	3

PTMA 9111 **APPLIED MATHEMATICS** **L T PC**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

UNIT I MATRICES 9

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley – Hamilton Theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms .

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions w = a + z , az, 1/z, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's Series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and Final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematics (40^{th} Edition), Khanna Publishers, Delhi (2007).
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., New Delhi (2007).

REFERENCES

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education (2007).
2. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt Ltd., New Delhi (2006).

PTPH9111 **APPLIED PHYSICS** **L T P C**
3 0 0 3

UNIT I ULTRASONICS **9**

Introduction – Production – magnetostriction effect - magnetostriction generator- piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C –scan displays, Medical applications - Sonograms

UNIT II LASERS **9**

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einstein's A and B coefficients - derivation. Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers- homojunction and heterojunction (Qualitative)- Industrial Applications - Lasers in welding, heat treatment and cutting – Medical applications - Holography (construction and reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS **9**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Splicing, Loss in optical fibre – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature and displacement - Endoscope.

UNIT IV QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one-dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT V CRYSTAL PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – 'd' spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy - Crystal defects – point, line and surface defects- Burger vector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2008).
2. Arumugam M. ' Engineering Physics', Anuradha Publications, Kumbakonam, (2007)
3. Sankar B.N and Pillai S.O. 'A text book of Engineering Physics', New Age International Publishers, New Delhi, 2007.

REFERENCES:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi (2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007)

PTCY9111 APPLIED CHEMISTRY L T P C
3 0 0 3

UNIT I WATER TREATMENT AND POLLUTION CONTROL 9

Treatment of water –impurities and disadvantages of hard water-Domestic and Industrial treatment - zeolite and ion exchange processes-Portable water-Boiler feed water – conditioning of boiler feed water. Scale and sludge formation –prevention –caustic embrittlement-boiler corrosion–priming and foaming Sewage treatment–Primary, secondary and tertiary treatment–significance of DO, BOD and COD-desalination – reverse osmosis. Control of water, air and land pollution.

UNIT II FUELS 9

Classification of fuels - Proximate and ultimate analysis of coal - coke manufacture - Otto Hoffman by product method-cracking-thermal and catalytic (fixed bed and fluidized bed)-petroleum-refining-factions-composition and uses synthetic petrol-fischer drops methods- Bergius process- knocking-octane number and cetane number-Preparation, composition and uses of producer gas , water gas and natural gas. Flue gas analysis-Orsat apparatus- gross and net calorific values- calculation of minimum requirement of air(simple calculations)- Explosive range –spontaneous ignition temperature

UNIT III THERMODYNAMICS AND SURFACE CHEMISTRY 9

Second law of thermodynamics-entropy and its significance- criteria for spontaneity- free energy-Gibbs, Helmholts and Gibbs-Helmholts equation-applications and problems – Adsorption –types of adsorption- adsorption of gases on solids- adsorption isotherm-Freundlich and Langmuir isotherms-adsorption of solutes from solutions- applications

UNIT IV ELECTROCHEMISTRY - CORROSION AND CATALYSIS 9

Reversible and irreversible cells-electrode potentials-types of electrodes-cell reactions-Nernst equations- electrochemical and galvanic series-fuel cells and solar cells-corrosion-chemical and electrochemical-factors affecting corrosion-sacrifical anode-impressed current cathodic protection-surface treatment and protective coating-Catalysis –classification-characteristics of catalysis – auto catalysis- enzyme catalysis

UNIT V POLYMERS-COMPOSITES AND NANOCHEMISTY 9

Polymers-definition-classification-thermoplastics and thermosetting plastics differences Preparation, properties and uses of polystyrene, bakelite, PET, polyurethane, Teflon, ureafromaldehyde, polycarbonates-Elastomers-Preparation, properties of Buna-S, nitrile, neoperene and butyl rubber, silicon rubber. Composites-FRP. Nanochemistry-introduction to nanochemistry- preparation and properties of nonmaterial-nano rods, nano wires-nanotubes-carbon nanotubes and their applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Dhara S S A text book of Engineering Chemistry, S.Chand & Co Ltd,New Delhi,2002
2. Jain. P.C and Monica Jain, Engineering Chemistry, Dhanpet Rai & Sons,New Delhi 2001

REFERENCES

1. Puri B R.,Sharma L R and Madhan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. Jalandar-2000.
2. G.B. Sergeev, Nanochemistry.Elsevier Science, New York,2006
3. V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras (2006).

PTGE9151 **ENGINEERING MECHANICS** **L T P C**
3 0 0 3

AIM:

To introduce the basic principles which help to understand motion and/or forces involved in engineering applications

OBJECTIVE:

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. The student should be able to understand the laws of motion, the kinematics of motion and the interrelationship. The student should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS **9**

Introduction - UNITs and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations on forces, dot product and cross product - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a forces – Forces in space - Equilibrium in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

UNIT II EQUILIBRIUM OF RIGID BODIES **9**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS **9**

Determination of Areas and Volumes – First moment of area and the Centroid of standard sections – T section, I section, Angle section, Hollow section – second and product moments of plane area – Rectangle, triangle, circle - T section, I section, Angle section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia - Mass moment of inertia – Derivation of mass moment of inertia for rectangular solids, prism, rods, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES **9**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum

UNIT V CONTACT FRICTION & ELEMENTS OF RIGID BODY DYNAMICS **9**

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling friction – Belt friction Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion – Impact of elastic bodies

TOTAL: 45 PERIODS

TEXT BOOK:

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2007.

REFERENCES:

1. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition – PHI / Pearson Education Asia Pvt. Ltd., 2003
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002
4. J.L. Meriam & L.G. Karige, Engineering Mechanics Vol. I & Vol. II, V edition, John Wiley & Sons, 2006.
5. P. Boresi & J. Schmidt, Engineering Mechanics Statics & Dynamics, Micro Print Pvt. Ltec., Chennai, 2004.

PTEC9161 ELECTRONICS ENGINEERING L T P C
3 0 0 3

AIM: To provide knowledge in the basic concepts of Electronic components, devices and circuits.

OBJECTIVE: To impart knowledge to the students on various Electronic components, devices and circuits.

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy hand theory – Intrinsic semiconductors – Extrinsic semiconductors – P type and N type – P-N Junction – VI characteristic of PN junction diode – Zener effect – Zener diode – Zener diode characteristic – Zener diode as a regulator - Half wave and full wave rectifiers

UNIT II TRANSISTORS AND AMPLIFIERS 9

Bipolar Junction Transistor – CB, CE, CC Configurations and characteristics – Biasing circuits – Fixed bias, Voltage divider bias – Concept of feed back – Negative feedback – Voltage series feedback amplifier – Current series feedback amplifier – Principles of Tuned amplifiers

UNIT III POWER AND CONTROL ELECTRONIC DEVICES 9

FET – Configuration and characteristics – FET amplifier – SCR, Diac, Triac, UJT – Characteristics and simple applications

UNIT IV SIGNAL GENERATORS AND LINEAR IC's. 9

Sinusoidal oscillators – Positive feed back – RC phase shift, Hartley's, Colpitt's, Wien bridge oscillators – Multivibrators – Operational amplifier – Adder, Multiplier, Integrator and Differentiators

UNIT V DIGITAL ELECTRONICS 9

Boolean algebra – Decoder - Encoder – Multiplexer – De-multiplexer - Half and Full adders – Flip flops – Digital to Analog and Analog to Digital conversions

TOTAL : 45 PERIODS

TEXT BOOK:

1. Malvino, "Electronic Principles", McGraw Hill Book Co., 1993.

REFERENCES:

1. Grob. B and Schultz. M.E., "Basic Electronics", Tata Mcraw Hill, 2003.
2. Thomas L. Floyd, "Electronic Devices", Pearson Education, 2002.
3. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, 2003.

PTMA 9212 TRANSFORMS AND PARTIAL DIFFERETIAL EQUATIONS L T P C
(Common to all branches of BE / B.Tech (Part-Time) Programmes) **3 0 0 3**

AIM:

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties–Transform of elementary functions–Convolution theorem– Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z - TRANSFORM AND DIFFERENCE EQUATIONS 9

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publications (2007)

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics, Pearson Education (2007)
2. Ramana, B.V. "Higher Engineering Mathematics" Tata McGraw Hill (2007).
3. Bali, N.P. and Manish Goyal, "A Text Book of Engineering 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

PTGE9261 ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to all branches) **L T P C**

3 0 0 3

AIM:

The AIM: of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE:

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land

resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PTME9201 MANUFACTURING TECHNOLOGY – I L T P C
3 0 0 3

AIM: To gain the comprehensive knowledge about the manufacturing processes

OBJECTIVE: This course AIM:s to impart the knowledge about various manufacturing processes. It deals with metal casting, metal forming and metal joining processes. After this course, a student will have a good exposure about the manufacturing processes and various operations and machinery. This also gives the recent trends in these processes also.

UNIT I FOUNDRY TECHNOLOGY 11

Pattern and core making – moulding sand and testing - green sand moulding – melting furnaces: cupola and induction furnaces – special casting processes – shell, investment, die casting, centrifugal castings principles of gating system design - fettling and finishing of castings – defects in casting.

UNIT II HOT AND COLD WORKING 7

Hot and cold working process, rolling – introduction – rolling mills – rolling operations – production of seamless tube.

UNIT III FORGING 9

Introduction – forging operations – drop forging – warm forging – extrusion and drawing: extrusion practice – hot, cold, impact and hydrostatic extrusion. drawing process: defects and residual stresses, drawing equipment, stretch forming, deep forming, spinning processes and sheet metal forming.

UNIT IV ADVANCES IN FORMING PROCESS 9

High energy rate forming process; explosive forming, electro- hydraulic, electro magnetic forming, dynapack machine, advances in super forging. plastic materials and processes: types of plastics – types of moulding – compression moulding - transfer moulding – injection moulding – Powder Metallurgy - Advances in Manufacturing Processes

UNIT V PRINCIPLES AND APPLICATIONS OF JOINING PROCESSES 9

Gas welding, basic arc welding processes: thermit welding, electron beam welding, laser beam welding, and solid state welding: cold welding, ultrasonic welding, friction welding, resistance welding and explosive welding and welding defects. principles and applications of brazing and soldering – recent development in joining processes.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2006

REFERENCES:

1. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson Education, 2006
2. Hajra Choudhury S.K and Hajra Choudhury. A.K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E, Black J.T. and Ronald A. Kosher, Elighth Edition, Materials and Processes, in Manufacturing Prentice – Hall of India, 1997.
4. Sharma, P.C., A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
5. P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, TMH-2003; 2nd Edition, 2003.
6. S. Gowri, P. Hariharan, A. Suresh Babu, Manufacturing Technology I, Pearson Education, 2008

PTEE9211 ELECTRICAL DRIVES AND CONTROL PREREQUISTE
Basic Electrical Engineering L T P C
3 0 0 3

AIM:
To provide knowledge in the area of electrical dives and their control techniques

OBJECTIVE:
To impart knowledge on
I. Basics of electric drives
II. Different speed control methods
III. Various motor starters and controllers
IV. Applications

UNIT I INTROUDCTION 9
Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors. Relay – control transformers.

UNIT II SPEED CONTROL OF DC MACHINES 9
DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits-chopper circuits.

UNIT III SPEED CONTROL OF AC MACHINES 9
Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

UNIT IV MOTOR STARTERS AND CONTROLLERS 9
DC motor starters : using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI -starter and auto transformers starter.

UNIT V HEATING AND POWER RATING OF DRIVE MOTORS 9
Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

TOTAL : **45 PERIODS**

TEXT BOOKS:

1. N.K De and P.K Sen ‘Electric Drives’ Prentice Hall of India Private Ltd, 2002.
2. Vedam Subramaniam ‘Electric Drives’ Tata McGraw Hill , New Delhi, 2007
3. V.K Mehta and Rohit Mehta ‘ Principle of Electrical Engineering’ S Chand & Company,2008

REFERENCES:

1. S.K Bhattacharya Brinjinder Singh ‘Control of Electrical Machines’ New Age International Publishers, 2002.
2. John Bird ‘Electrical Circuit theory and technology’ Elsevier, First Indian Edition, 2006.

PTME9303 HYDRAULICS AND PNEUMATICS L T P C
3 0 0 3

AIM: To understand the basis of fluid power and its application in Industrial automation.

OBJECTIVES:
This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

UNIT I FLUID POWER PRINCIPLES AND FUNDEMENTALS (REVIEW) 3
Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal's Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 13
Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders – Types and construction, Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications – Types of actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches- Applications- Fluid Power ANSI Symbol.

UNIT III HYDRAULIC CIRCUITS 9
Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT IV PNEUMATIC SYSTEM 8
Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

UNIT V DESIGN OF HYDRALIC AND PNEMATIC CIRCUITS 12
Designing the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press. – Selection, fault finding and maintenance of hydraulic components- Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components – Installation fault finding and maintenance of pneumatic components. Microprocessor and PLC- Applications in Hydraulic and Pneumatics- Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Anthony Esposito," Fluid Power with Applications", PHI / Pearson Education, 2005.

REFRENCES:
1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
2. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw Hill, 2001
3. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007.
4. Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.
5. Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

PTME9251 MANUFACTURING TECHNOLOGY – II L T P C
3 0 0 3

AIM:
To provide the concepts and working principal of special machineries and recent trends in manufacturing.

OBJECTIVE:
To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of (CNC) Computer Numerical Control of Machine tools and CNC Programming.

UNIT I THEORY OF METAL CUTTING 8
Mechanics of chip formation, single point cutting tool, forces in machining, thermal aspects of chip formation. orthogonal metal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 10
Centre lathe, constructional features, specification, cutting tools, nomenclature various operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. capstan and turret lathes – tool layout, - automatic lathes: semi automatics – single spindle: swiss type, automatic screw type- multi spindle:

UNIT III RECIPROCATING MACHINES, MILLING MACHINES & GEAR CUTTING 12
Reciprocating machine tools: shaper, planer, slotter: milling: types, milling cutter attachments, change gear calculations, machining time calculation, operations. hole making: drilling, reaming, boring, tapping, machining time calculations. gear cutting: forming, generations, shaping, planning and hobbing-tool and cutter grinders.

UNIT IV ABRASIVE PROCESS, BROACHING 8
Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding , surface grinding, centreless grinding, internal grinding-honing, lapping, super finishing, polishing and buffing, abrasive jet grindling, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 7
Numerical control (NC) machine tools – CNC types, constructional details, special features. machining centre, training centre.part programming fundamentals – manual programming.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Roy. A. Lindberg, “Process and Materials of Manufacture”, PHI / Pearson Education Fourth , Edition 2006.
2. Rao. P.N “ Manufacturing Technology”, Metal Cutting and Machine Tools, Tata Mc Graw–Hill, New Delhi, 2003.

REFERENCES:

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J. White. “Machine Tool Practices”, Prentice Hall of India, 1998
2. HMT – Production Technology, Tata Mc Graw Hill, 1998.
3. Hajra Choudhury. Elements of Workshop Technology – Vol.II. Media Promoters.
4. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, Mc Graw Hill, 1984.

PTCE9213 **STRENGTH OF MATERIALS** **L T P C**
3 0 0 3

AIM:
To understand the stresses and strains for different types loads for various applications.

OBJECTIVES:
- To understand the stresses developed in beams under transverse load
- To understand the shear stress developed due to tensional load
- To understand the stresses induced in cylinders and spheres due to internal pressure.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 8
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic Constants – Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSEVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 11
Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 8
Torsion formulation Stresses and deformation in circular and hollows shafts – Stepped shafts – deflection in Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV DEFLECTION OF BEAMS 10
Double Integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam and strain energy method – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses – deformation in thin cylinders –spherical shells subjected to internal pressure – deformations in spherical shells - Lame's theory – application of theories of failure

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Rajput.R.K. "Strength of Materials" S.Chand & co Ltd. New Delhi 1996
2. Jindal U.C. "Strength of Materials" Asian Books Pvt Ltd, New Delhi 2007

REFERENCES:

1. Egor. P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 1997
2. Subramanian R. "Strength Of Materials" Oxford University Press, Oxford Higher Education Series ,2007
3. Hibbeler , R.C, Mechanics Of Materials", Pearson Education, Low Price Edition,2007
4. Bansal, R.K. Strength Of Materials, Lakshmi Publications(P)Ltd, New Delhi
5. Ferdinand P Been, Russell Johnson,J.R. & John J Dewole Mechanics Of Materials, Tata Mcgraw Hill Publishing Co Ltd, New Delhi, 2006

PTME9202 ENGINEERING THERMODYNAMICS L T P C
3 0 0 3

AIM: To train the students with Heat Energy basics and its governing principles.

OBJECTIVE:
The student must acquire the knowledge capability of analyzing and solving any concept or problem associated with heat energy dynamics and utilization.

UNIT I BASIC CONCEPT AND FIRST LAW 9
Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW AND ENTROPY 9
Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNIT III THERMODYNAMIC AVAILABILITY 9
Basics – Energy in non-flow processes : Expressions for the Exergy of a closed system- Equivalence between mechanical energy forms and Exergy – Flow of energy associated with heat flow – Exergy consumption and entropy generation. Exergy in steady flow processes : Expressions for Exergy in steady flow processes – Exergy dissipation and entropy generation.

UNIT IVPROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9
Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

UNIT V PSYCHROMETRY 9
Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

TOTAL : 45 PERIODS

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted)

TEXT BOOKS :

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Lynn D Russell, George A, Adebiyi "Engineering Thermodynamics" Indian Edition, Oxford 3, University Press, New Delhi, 2007.

REFERENCES :

1. Yunus A angel and Michael Boleo, Thermodynamics An Engineering Approach
2. E.Ratha Krishnan, Fundamentals of Engineering Thermodynamics, 2nd Edition, Prentice – Hall of India Pvt. Ltd, 2006
3. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
6. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.

PTME9252 ENGINEERING MATERIALS AND METALLURGY L T P C
3 0 0 3

AIM:

To produce the fundamentals of materials and metallurgical aspects involved in design materials and its processing.

OBJECTIVES:

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitials – Phase diagrams and microstructure development: Isomorphous, eutectic, peritectic, eutectoid and alloy systems. Iron-Iron carbide equilibrium diagram, peritecoid.

UNIT II HEAT TREATMENT 9

Full annealing-stress relief, Recrystalisation- Spheroidizing, Normalising, Hardening and tempering of steel. Isothermal transformation diagrams- Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburizing, nitriding, cyaniding, carbonotriding –flame and induction hardening – vacuum and plasma hardening – current trends- thermo-mechanical treatments- elementary ideas on sintering.

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W)- classification of steels (tool steel, stainless)– cast irons – alloy cast irons- Copper and Copper alloys – Aluminum and its alloys- Magnesium and its alloys– Titanium and its alloys- Nickel and Cobalt alloys, properties and applications of these materials.

UNIT IV NON-METALLIC AND NEWER MATERIALS 9

Types, properties and applications: Polymers, Ceramics and Composites– Super conductors- nanomaterials and their properties.

UNIT V MECHANICAL PROPERTIES AND TESTING 9

Crystal imperfections- Dislocations- Strengthening mechanisms- Elastic, anelastic and viscoelastic behaviour – modulus of elasticity- plastic deformation- Mechancial tests-tension, compression, impact, hardness- effect of temperature, grain size , solutes and precipitates on dislocation dynamics – Mechanism of Fracture - mechanism of creep-creep resistant materials- creep tests- fracture toughness- ductile-brittle transition – deformation mechanism maps- fatigue fracture-fatigue test.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Raghavan. V. Materials Science and Engineering", Prentice Hall of India Pvt. Ltd, 5th edition, 2007.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2007.

REFERENCES:

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
2. Sydney H Avner, "Introduction to Physical Metallurgy", 2/E Tata McGraw Hill Book, Company, 2007.
3. Kenneth G. Budinski and Michael K. Budinski "Engineering Materials", PHI / Pearson Educations, 8th Edition, 2007.
4. G.S. Upadhay and Anish Upadhay, "Materials Science and Engineering", Viva Books Pvt. Ltd, 2006.
5. James F. Shackelford and Madanpalli K. Muralidhara, Introduction to Materials Science for Engineers, Pearson Education, 6th edition, 2007.
6. Donald R. Askeland and Pradeep P. Phulé, The Science and Engineering of Materials, Thomson 5th edition, 2007.

PTME9203 KINEMATICS OF MACHINES L T P C
3 0 0 3

AIM:

To impart knowledge of motion characteristics of mechanisms and machine, and to make the students to develop new mechanisms.

OBJECTIVE:

- To understand the basic components and layout of linkages in the assembly of a system/machine.
- To understand the principles involved in assembly the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages.
- To understand and to design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains.
- To understand the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Dwell mechanisms, Ratchets and Escapements, Universal Joint – Basic structures of Robot Manipulators (serial & parallel) – Design of quick return crank-rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method – Velocity and acceleration polygons – Velocity analysis using instantaneous centres – Kinematic analysis by complex algebra methods – Vector approach – Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, cycloidal and polynomial motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] – Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials – Automobile gear box.

UNIT V FRICTION 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ambekar A.G, “Mechanism and Machine Theory” Prentice Hall of India, New Delhi, 2007.
2. Shigley J.E.,Pennock G.R.and Uicker.J.J.,‘Theory of Machines and Mechanisms’, Oxford University Press,2003.

REFERENCES:

1. Thomas Bevan, ‘Theory of Machines’, CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, ‘Theory of Mechanisms and Machines’, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Rao.J.S. and Dukkipati.R.V. ‘Mechanisms and Machine Theory’, Wiley-Eastern Ltd., New Delhi, 1992.
4. John Hannah and Stephens R.C., ‘Mechanics of Machines’, Viva Low-Prices Student Edition, 1999.
5. V.Ramamurthi, Mechanics of Machines, Narosa Publishing House, 2002.
6. Robert L.Norton, Design of Machinery, McGraw-Hill, 2004.

STANDARDS:

IS 2458 : 2001, Vocabulary of Gear Terms – Definitions related to Geometry.
IS 3756 : 2002, Method of Gear Correction – Addendum modification for External cylindrical gears with parallel axes.
IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
IS 12328 : 1988 Bevel Systems Part – 2 Spiral Bevel Gears.

PTME9304 MODERN MACHINING PROCESSES L T P C
3 0 0 3

AIM:

To provide knowledge on recent developments in unconventional machining process.

OBJECTIVES:

1. To understand material removal by using various forms of Energy.
2. To know about new materials and how complex parts are produced with high accuracy by using new technology.

UNIT I INTRODUCTION 7

Need of Newer Machining Processes – Classification Based on Energy, Mechanism, source of energy, transfer media and process - Process selection-Based on Physical Parameters, shapes to be machined, process capability and economics.

UNIT II MECHANICAL PROCESS 10

Ultrasonic Machining: Principle- Transducer types – Concentrators - Abrasive Slurry - Process Parameters – Tool Feed Mechanism – Advantages and Limitations – Applications. Abrasive Jet Machining: Process- Principle – Process Variables – Material Removal Rate - Advantages and Limitations – Applications. Water Jet Machining: Principle – Process Variables - Advantages and Limitations – Practical Applications

UNIT III ELECTRICAL DISCHARGE MACHINING AND ELECTRICAL DISCHARGE WIRE CUT 10

Electrical Discharge Machining: Mechanism of metal removal – Dielectric Fluid – Electrode Materials - Spark Erosion Generators – Electrode Feed System – Material Removal Rate – Process Parameters – Tool Electrode Design – Characteristics of Spark Eroded Surfaces- Advantages and Limitations – Practical Applications Electrical Discharge Wire Cut and Grinding: Principle – Wire Feed System - Advantages and Limitations – Practical Applications

UNIT IV CHEMICALS AND ELECTRO CHEMICAL MACHINING 10

Chemical Machining: fundamentals, Principle –classification and selection of Etchant - chemical milling, Engraving, Blanking, Drilling and Trepanning-Advantages and limitations – Applications. Electro Chemical Machining: Electro-chemistry of the process-Electrolytes - Electrolyte and their Properties – Material Removal Rate – Tool Material – Tool Feed System – Design For Electrolyte Flow – Process Variables - Advantages and Limitations – Applications - Electro Chemical Grinding: Honing, cutting off, Deburring and turning.

UNIT V ELECTRON BEAM, LASER BEAM, ION BEAM AND PLASMA ARC MACHINING 8

Electron Beam Machining: Principle –Generation and control of electron beam-Advantages and Limitations – Applications. Laser Beam Machining: Principle –Solid and Gas Laser Application – Thermal Features of LBM - Advantages and Limitations – Applications. Ion Beam Machining: Equipment – process characteristics - Advantages and Limitations – Applications. Plasma Arc Machining: Principle –Gas mixture– Types of Torches – Process Parameters - Advantages and Limitations – Applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C Pandey And H.S. Shan, "Modern Machining Process", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2007
2. V.K. Jain, " Advanced Machining Process", Allied Publishers Pvt Limited 2007

REFERENCES:

1. Amithaba Bhattacharyya,"New Technology", The Institution Of Engineers , (India)
2. "Production Technology", HMT Bangalore, Tata Mc Graw–Hill Publishing Company Limited, New Delhi, 2006.

PTME9305 DESIGN OF MACHINE ELEMENTS L T P C
3 0 0 3

AIM: To impart knowledge on design principles of various components in mechanical engineering application.

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties -- Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS 10

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of crankshafts -- Design of rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 9

Threaded fastners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 8

Design of various types of springs, optimization of helical springs -- rubber springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 9

Sliding contact and rolling contact bearings -- Design of hydrodynamic journal bearings, McKee's Eqn., Sommerfield Number, RAIM:ondi & Boyd graphs, -- Selection of Rolling Contact bearings -- Design of Seals and Gaskets -- Design of Connecting Rod.

TOTAL : 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, “Design of Machine Elements”, Second Edition, Tata McGraw-Hill Book Co, 2007.

REFERENCES:

1. Sundararajamoorthy T. V, Shanmugam.N, "Machine Design",Anuradha Publications, Chennai, 2003.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Ugural A.C, “Mechanical Design – An Integral Approach, McGraw-Hill Book Co,2004.
4. Spotts M.F., Shoup T.E “Design and Machine Elements” Pearson Education, 2004.

STANDARDS:

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

PTME9253 DYNAMICS OF MACHINES L T P C

3 0 0 3

AIM:

To impart the knowledge about the effect of forces on the machines and the methods to control them.

OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces.
- To understand the force-motion analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for governing of machines.

UNIT I FORCE ANALYSIS 9

Applied and constraint forces – Free body diagrams – Static equilibrium conditions – Two, three & four members – Static force analysis of simple mechanisms – Dynamic force analysis – Inertia force and Inertia torque – D Alembert’s principle – The principle of superposition – Dynamic Analysis in reciprocating engines – Gas forces – Equivalent masses – Bearing loads – Crank shaft torque – Turning moment diagrams – Fluctuation of energy – Fly Wheels – Engine shaking forces – Cam dynamics – Unbalance, Spring Surge and Windup.

UNIT II BALANCING 9

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in locomotive engines – Balancing of linkages – Balancing machines.

UNIT III FREE VIBRATION 9

Basic features of vibratory systems – Idealized models of basic elements and lumping of parameters – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration – Extending to multi degree freedom systems – Critical speeds of shafts – Torsional vibration – Torsionally equivalent shaft – Two and three rotor systems.

UNIT IV FORCED VIBRATION 9

Response to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion – force transmissibility and amplitude transmissibility – Vibration isolation.

UNIT V MECHANISM FOR CONTROL 9

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force – Other Governor mechanisms. Gyroscopes – Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL :45 PERIODS

TEXT BOOKS:

1. Ambekar A.G.,"Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 2007.
2. Shigley J.E., Pennock,G.R., Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press,2003.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
3. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, New Delhi, 1992

PTME9254 THERMAL ENGINEERING – I L T P C
3 0 0 3

AIM: To increase the students with Heat energy applications

OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process.
- To apply the thermodynamic concepts into various thermal application like, IC engines Steam turbines, Gas Turbines

UNIT I GAS POWER CYCLES 9

Otto, Diesel, Dual, Brayton cycles - Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Two stroke and Four stroke engines – Isentropic flow, Fanno flow, and Rayleigh flow.

UNIT II AIR COMPRESSOR **9**

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor., Problems in single and two stage air compressors. Various types of compressors.

UNIT III INTERNAL COMBUSTION ENGINES AND ITS SYSTEMS **9**

Classification of IC engine - components and functions. Actual and theoretical Valve timing diagram, port timing diagram and p-V diagrams. Comparison of two stroke & four stroke engines and SI and CI engines.

UNIT IV INTERNAL COMBUSTION ENGINE FUELS, COMBUSTION & PERFORMANCE **9**

Comparison of petrol and diesel engine Fuels. Air-fuel ratio calculation, Knocking and Detonation, Lubrication system and cooling system Performance calculation. Exhaust gas analysis, pollution control norms.

UNIT V GAS TURBINES **9**

Open and closed Gas turbine cycles –Methods of Cycle improvement - Regeneration – Intercooling - Reheating and their combinations –Performance- Materials.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rajput, R.K., Thermal Engineering, 6th Edition, Laxmi Publications, 2007
2. Ballaney, P.L., "Thermal Engineering" , Khanna Publishers, 24th Edition, 2003.

REFERENCES:

1. Holman, J.P." Thermodynamics", McGraw Hill, 1965.
2. Rudramoorthy, R.,Thermal Engineering, 4th Edition, Tata McGraw Hill, New Delhi, 2006.
3. Domkundwar, Kothandaraman, and Domkundwar,A Course in Thermal Engineering, Dhanpat Raj & Sons, Fifth edition, 2002.

PTME9308 THERMAL ENGINEERING LABORATORY **L T P C**
0 0 3 2

AIM:

To train the students with principle and operation of thermal Energy based

LIST OF EXPERIMENTS

I.C. ENGINE LAB AND FUELS LAB **15**

1. Valve Timing and Port Timing diagrams.
2. Performance Test on 4 – stroke Diesel Engine.
3. Heat Balance test on 4 – stroke Diesel Engine.
4. Morse Test on Multicylinder Petrol Engine.
5. Retardation Test on a Diesel Engine.
6. Determination of Flash Point and Fire Point.

STEAM LAB **15**

Study of Steam Generators and Turbines.

Performance and Energy Balance Test on a Steam Generator.

Performance and Energy Balance Test on Steam Turbine.

TOTAL : 30 PERIODS

PTME9301 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS **L T P C**
3 0 0 3

AIM:

To appreciate and understand the importance of tool design in the overall product cycle.

OBJECTIVES:

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES **8**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES **10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES & ELEMENTS OF CUTTING DIES 10

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES **10**

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOPICS **7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled

machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.
(Use of Approved design Data Book permitted).

TEXT BOOKS:

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold "Tool Design", III rd Edition Tata McGraw Hill, 2000.

REFERENCES:

1. K. Venkataraman, "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.Kempster, "Jigs and Fixture Design", Hoddes and Stoughton – Third Edition 1974.
2. Joshi, P.H. "Press Tools" – Design and Construction", Wheels publishing, 1996.
3. Hoffman "Jigs and Fixture Design" – Thomson Delmar Learning, Singapore, 2004.
4. ASTME Fundamentals of Tool Design Prentice Hall of India.
5. Design Data Hand Book, PSG College of Technology, Coimbatore.

PTME9302 THERMAL ENGINEERING – II L T P C
3 0 0 3

AIM:

To inculcate the students with Heat Energy applications

OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process.
- To apply the thermodynamic concepts into various thermal applications like boilers, Compressors and Refrigeration and Air conditioning Systems and waste heat recovery systems.

UNIT I BOILERS 9

Types, Rankine cycle – Analysis – thermal calculations – Heat balance – Accessories – Types of boilers – Boiler code.

UNIT II STEAM NOZZLE 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ration, supersaturated flow.

UNIT III STEAM TURBINES 9

Types – Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations – governors.

UNIT IV COGENERATION AND WASTE HEAT RECOVERY 9

Cogeneration Principles – Cycle analysis – Applications – source and Utilization of waste heat – systems – Heat exchangers – Economic analysis.

UNIT V REFRIGERATION AND AIR – CONDITIONING 9

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption, Air cycle, Ejector, Steam, Thermoelectric refrigeration systems, Psychormetric, Psychormetric chart,

Instrumentation, Cooling load calculations and air circulating systems, Concept of RSHF, GSHF, ESHF – Air conditioning systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajput, "Thermal Engineering", S. chand Puclishers, 2000.
2. Rudramoorthy R, "Thermal Engineering", Tata MC Graw Hill, New Delhi, 2003.

REFERENCES:

1. Kothandaraman , C.P., Domkundwar .S and A.v. Domkundwar", a course in thermal Engineering", Dhanpal Rai & sons, fifth edition, 2002.
2. Holman .J.P., "Thermodynamics", McGraw Hill, 1985.
3. Arora .C.P., "Refrigeration and Air Conditioning", TMH, 1994.
4. Charles H Butler : Cogeneration" McGraw Hill, 1984.
5. Sydney Reiter "Industrial and commercial heat recovery systems " Van Nostrand Reinhols, 1985.
6. David Gunn, Robert Horton, Industrial Boilers – Longman Scientific and Technical Publication, 1986.

PTME9402 MECHATRONICS L T P C
3 0 0 3

OBJECTIVE

This syllabus is formed to create knowledge in Mechatronic systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives a framework of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT I INTRODUCTION 5

Introduction to Mechatronics - Systems - Concepts of Mechatronics approach - Need for Mechatronics - Emerging area of Mechatronics - Classification of Mechatronics.

UNIT II SENSORS AND TRANSDUCERS 12

Introduction - Performance Terminology – Potentiometers - LVDT - Capacitance sensors - Strain gauges - Eddy current sensor - Hall effect sensor - Temperature sensors - Light sensors - Selection of sensors - Signal processing.

UNIT III MICROPROCESSOR AND INTERFACING 13

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters - Applications - Temperature control - Stepper motor control - Traffic light controller.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 8

Introduction - Basic structure - Input and output processing - Programming - Mnemonics-Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V DESIGN AND MECHATRONICS 7

Design process - stages of design process - Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Engine Management system - Automatic car park barrier.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Bolton.W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003

REFERENCES:

1. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing Company, 2007.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008
3. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006
4. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applicatlions” Tata McGraw-Hill Publishing company Limited, 2003.
5. Michael B.Histand and Davis G.Alciatore,” Introduction to Mechatronics and Measurement systems”. McGraw Hill International edition, 1999.
6. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, “Mechatronics” Nelson Thornes ltd, Eswar press, Indian print, 2004.
7. Lawrence J.Kamm, “Understanding Electro-Mechanical Engineering – An Introduction to Mechatronics”, Prentice Hall of India Pvt Ltd, 2000.
8. Dan Necsulescu, “Mechatronics”, Pearson education, 2002.
9. Newton C.Braga, “Mechatronics Sourcebook”, Thomson Delmar Learning, Eswar Press, 2003.

PTME9353 DESIGN OF TRANSMISSION SYSTEMS L T P C
3 0 0 3

AIM:

To learn the design principles of various mechanical power transmission systems.

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of power Transmission components.
- To understand the standard procedure available for Design of Transmission systems
- To learn to use standard data and catalogues

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.

Design of plate clutches–axial, clutches-cone clutches, internal expanding rim clutches-internal and external shoe brakes.

TOTAL: 45 PERIODS

Note: (Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition, Tata McGraw-Hill , 2003.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

REFERENCES:

1. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw Hill, 1985.
2. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000,
4. Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Book Co., 1999.
5. Ugural A,C, "Mechanical Design, An Integrated Approach", McGraw-Hill , 2003.

STANDARDS:

IS 4460 : Parts 1 to 3 : 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.

IS 7443 : 2002, Methods of Load Rating of Worm Gears

IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, Pl and PM Profiles : Dimensions

IS 2122 : Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 1 Flat Belt Drives.

IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2 V-Belt Drives.

PTME9306 METROLOGY AND MEASUREMENTS L T P C
3 0 0 3

AIM:

To understand the basics involved in the equipments meant engineering measurements.

OBJECTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF METROLOGY 5

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Gauges and Comparator - Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 10

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchangeability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 12

Basic concept of lasers, advantages of lasers – laser interferometers – types – DC and AC lasers interferometer – Applications – Straightness – Alignment, Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT 10

Principles and Methods of straightness – Flatness measurement – Thread measurement, Gear measurement, Surface finish measurement, Roundness measurement – Form and Surface measurement – Thread and Gear measurement - Applications.

UNIT- V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 8

Force, Torque, pressure, Power – Mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, Rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and calibration – Readability and Reliability

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 2005
2. Gupta.I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.

REFERENCES:

1. Shotbolt, “Metrology for Engineers, McGraw Hill, 1990.
2. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.

PTME9354 COMPUTER AIDED DESIGN AND MANUFACTURE L T P C
3 0 0 3

AIM:

To learn the importance and use of computer in design and manufacture.

OBJECTIVES:

- To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture
- To understand the need for integration of CAD and CAM

UNIT I COMPUTER AIDED DESIGN 9

Product cycle- The design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates-Line drawing -Clipping- viewing transformation- visual realism

UNIT II GEOMETRIC MODELLING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves- Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep – Introduction to model storage – Data structures for interactive modeling- integration of design analysis and CAD- customization and design automation

UNIT III CAD STANDARDS AND CAD-CAM INTERFACE 9

Graphics and computing standards- Data exchange standards- IGES-STEP – communication standards- current trends in manufacturing engineering- Group technology- design for manufacture and assembly – process planning techniques – Total approach to product development – techniques of quality engineering – QFD and FMEA – Taguchi methods – Rapid prototyping

UNIT IV MANUFACTURING ASPECTS 9

Fundamentals of Numerical control – CNC technology – CNC hardware basics- CNC Tooling and machine tools- Control systems – CNC Programming – Manual programming – Computer assisted part programming – APT language structure and commands-

UNIT V PRODUCTION PLANNING AND CONTROL 9

Introduction to production planning and control- Lean production- business process reengineering- just in time approach- setup reduction –Kanban- Product data management- Assembly and tolerance modeling Product life cycle management – use of world wide web in product development

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles, practice and manufacturing management “ Pearson Education Asia – 2001
2. P.N.Rao “CAD/CAM Principles and Applications” Tata McGraw-Hill Publishng Co. New Delhi – 2002

REFERENCE:

1. Ibrahim Zeid “CAD CAM Theory and Practice” Tata McGraw-Hill Publishng Co.1998

PTME9355 HEAT AND MASS TRANSFER L T P C
3 0 0 3

AIM:

To make the student to understand and deal with various modes of Heat transfer.

OBJECTIVES:

- To understand the mechanism of steady and unsteady conduction heat transfer and extended surfaces.
- To understand the principles and application of various convective heat transfer correlations.
- To understand the concepts of radiation heat transfer.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

UNIT I CONDUCTION 9

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Infinite and Semi Infinite Solids

UNIT II CONVECTION 9

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Forced Convection – External Flow – Flow over Plates, Cylinders Spheres and Bank of tubes – Internal Flow – Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselt's theory of condensation- Regimes of pool boiling and flow boiling, correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method, - NTU method.

UNIT IV RADIATION 9

Basic Concepts, Laws of Radiation – Wiens Displacement Law - Stefan Boltzman Law, Kirchoff Law – Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields.

UNIT V MASS TRANSFER 9

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Yunus A. Cengel, Heat Transfer A Practical Approach – Tata Mc Graw Hill - 2004

REFERENCES

1. Frank P. Incropera and David P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 1998.
2. S.P. Venkateshan, Heat Transfer, Ane Books, New Delhi, 2004.
3. Ghoshdastidar, P.S, Heat Transfer, Oxford, 2004,
4. Nag, P.K., Heat Transfer, Tata Mc Graw Hill, New Delhi, 2002
5. Holman, J.P., Heat and Mass Transfer, Tata Mc Graw Hill, 2000
6. Ozisik, M.N., Heat Transfer, McGraw Hill Book Co., 1994.
7. Kothandaraman, C.P., Fundamentals of Heat and Mass Transfer, New Age International, New Delhi, 1998.
8. Yadav, R., Heat and Mass Transfer, Central Publishing House, 1995.

PTME9357 CAD/ CAM LAB L T P C
0 0 3 2

AIM:

To give the exposure to usage of software tools for design and manufacture.

OBJECTIVES:

1. To be able to understand and handle design problems in a systematic manner.
2. To gain practical experience in handling 2D drafting and 3D modeling software systems.
3. To be able to apply CAD in real life applications.
4. To understand the concepts G and M codes and manual part programming.
5. To expose students to modern control systems (Fanuc, Siemens etc)
6. To know the application of various CNC machines
7. To expose students to modern CNC application machines EDM, EDM wire cut and Rapid Prototyping

UNIT I 3D GEOMETRIC MODELING

Creation of 3D Models - Wire Frame, Surface, Solid modeling Techniques Using CAD Packages – CSG, B-Rep Approaches in Solid Modeling - Feature Based Modeling Technique – Assembly – Detailing - Exposure to Industrial Components – Application of GD&T

UNIT II STL FILE GENERATION – REVERSE ENGINEERING

UNIT III MANUAL CNC PART PROGRAMMING

Manual CNC Part Programming Using Standard G and M Codes - Tool Path Simulation – Exposure to Various Standard Control Systems- Machining simple components by Using CNC machines.

UNIT IV COMPUTER AIDED PART PROGRAMMING

CL Data Generation by Using CAM Software– Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.

UNIT V STUDY OF EXPERIMENTS

Multi-axial Machining in CNC Machining Center –EDM – EDM Wire Cut - Rapid Prototyping

TOTAL: 45 PERIODS

PTGE9022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, III Ed, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd. (2006)
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd. (2006)

PTME9401 POWER PLANT ENGINEERING L T P C
3 0 0 3

AIM:
Impartation of the basic knowledge on Power Plant Engineering underscoring the development trends.

OBJECTIVES:
To provide a general perspective of Power Plant Engineering indicating the role of mechanical engineers in their operation and maintenance.

PREREQUISITE: The course is specific to Mechanical Engineering stream students only.

UNIT I LAYOUT OF POWER PLANTS 8
Schematics of various power plant systems – steam, hydel, piston engine, MHD, Gas turbine, Combined Cycle, Fuel cell, Cogeneration, Solar, Wind mill, OTEC, Comparisons, Selection.

UNIT II STEAM AND NUCLEAR POWER PLANTS 10
Steam generators including FBC, cycle analyses, subsystems of thermal analyses power plants, coal gasification technologies, Types of Nuclear Reactor plants – Indian Scenario, Environmental aspects of thermal and nuclear plants, Development trends.

UNIT III HYDEL AND OTHER POWER PLANTS 10
Essential elements of hydel power plants, selection of turbines, microhydel plant developments, pumped storage plants, Wind mill developments, specialities of fuel cell power plants – PAFC, MCFC, SOFC and PEM systems, Hybrid power plants, advanced piston engine and gas turbine power plants, geothermal power plants.

UNIT IV INSTRUMENTATION AND CONTROLS 8
Modern Control system of power plants, instrumentation for vital parameters like temperature, pressure, flow of steam, gas, water, flue gas etc.,flue/exhaust gas analyses, automatic controls.

UNIT V ECONOMICS, RENOVATION AND MODERNISATION OF POWER PLANTS 9
Load duration curves, costing of electrical energy, tariff types, load sharing economics, Renovation and modernisation of aged power plants, Development pathways for power plants – national and global scenario.

TOTAL: 45 PERIODS

TEXT BOOK:
1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2007.

REFERENCES
1. Standard Handbook of Powerplant Engineering, Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, McGraw – Hill, 1998, Second Edition.
2. Power Plant Engineering, Frederick T. Morse, Affiliated East-West-Press Private Ltd., New Delhi 1953.

PTME9451 PROJECT WORK L T P C
0 0 6 6

AIM:
To apply the knowledge gained from theoretical and practical courses in solving a problem so as to encourage students' creativity, planning, coordination etc.

OBJECTIVES:
A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The AIM: of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

PTME9021 ENERGY CONSERVATION AND MANAGEMENT L T P C
3 0 0 3

AIM:
To instruct the importance of energy conservation in both thermal and electrical energy and its management for the better utilization of resources.

OBJECTIVE:
At the end of the course, the student expected to do
- Understand and analyze the plant energy data
- Energy audit and suggest methodologies for energy savings
- Energy accounting and balance and
- Able to utilize the available resources in optimal way

UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8
World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing : methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

UNIT II ELECTRICAL SYSTEMS 12
AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

UNIT III THERMAL SYSTEMS 10
Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

UNIT IV ENERGY CONSERVATION **8**

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS **7**

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

TOTAL :45 PERIODS

TEXT BOOKS:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.

REFERENCES:

1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982
2. W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London 1987.

PTME9022 NEW AND RENEWABLE SOURCES OF ENERGY **L T P C**
3 0 0 3

AIM:

To instruct the importance of renewable energy and its utilization for the thermal and electrical energy needs and also the environmental aspects of theses resources.

OBJECTIVE:

At the end of the course, the student expected to do Understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization Economics of the utilization and environmental merits

UNIT I SOLAR ENERGY **9**

Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

UNIT II WIND ENERGY **9**

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

UNIT III BIO - ENERGY **9**

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics.

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY 9

Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

UNIT V NEW ENERGY SOURCES 9

Hydrogen, generation, storage, transport and utilisation, Applications : power generation, transport – Fuel cells – technologies, types – economics and the power generation

TOTAL:45 PERIODS

TEXT BOOKS:

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

REFERENCES:

1. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling & applications, Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990.

PTME9023 ADVANCED WELDING AND CASTING PROCESSES L T P C
3 0 0 3

AIM:

To provide students for knowledge an advanced welding and design aspects of costing.

OBJECTIVES:

- To provide knowledge on Newer developments in Metal Casting, Planning and management of foundry, Foundry Mechanization, design of gating and risering for casting
- To provide knowledge on Welding Metallurgy and Welding of dissimilar metals.

UNIT I WELDING OF DISSIMILAR METALS 8

Friction Welding Process – effect of speed and pressure – explosive welding – plasma arc welding – Electon beam welding – High frequency induction welding - Laser beam weding.

UNIT II WELDING METALLURGY 8

Weld thermal cycles – Heat Affected Zone(HAZ) – Weldability of steels – Cast Iron – Stainless steel,aluminium – Copper and Titanium alloys – Hydrogen embrittlement – Pro and post weld heat Treatments – weld defects – Testing of Welds.

UNIT III DESIGN OF GATING SYSTEM 11

Soldification,gating,risering and casting design solidification process – Gating System design pouring Time – Choke Area – Sprue – Other gating elements – Risering design -

Caines – modulus – Naval research Laboratory method – feeding distances – Chills feeding Aids – design of Castings.

UNIT IV FERROUS AND NON FERROUS CASTINGS 10

Steel Casting – The family of cast iron – melting of steels and cast irons – Grey iron foundry practice – Ductile iron – Malleable Iron casting design – Considerations Aluminium ,Magnesium,Copper,Zinc and Titanium alloys foundry practice.

UNIT V FOUNDRY MECHANISM 8

Mechanical equipments in foundry – plant site location, layout – Plant Engineering – Maintenance – Services – Practical aspects .

TOTAL: 45 PERIODS

TEXT BOOK:

1. P.N.Rao , Manufacturing Technology , Tat McGraw Hill, 2001

REFERENCES:

1. Heine , Loper and Rosenthal, Principles of Metal Casting ,Tata McGraw Hill,1994
2. A.K.Chakrabarti, Casting Technology and Cast Alloys, Prentice –Hall Of India Ltd, 2005
3. T.V.Rama Rao, Metal casting Principles and Practice, New Age International, 2007
4. Parmar, Welding Engineering and Technology, Khanna Publishers,2002
5. Little R.L.Welding and Welding Technology, McGraw Hill, NewYork 1973.

PTME9024 MECHANICAL VIBRATIONS AND NOISE L T P C
3 0 0 3

AIM:

To impart the knowledge of effects of vibrations and noise, and the methods to control them in engineering applications.

OBJECTIVES:

(i) To understand the Fundamentals of Vibration and Noise and its practical applications.
(ii) To understand the working principle and operations of various vibrations and noise measuring instruments
(iii) To understand the various Vibration and Noise control strategies

UNIT I FUNDAMENTALS OF VIBRATION 9

Introduction -Sources of vibration-Mathematical models-Types of vibration. Review of Single degree freedom systems with and without damping –Types of Damping-Dynamics of rotating and reciprocating engines– Critical speed of industrial rotors with specific reference to rigid and flexible rotors – Influence of type of bearings – Vibration isolation – Nonmetallic isolators

UNIT II TWO DEGREE FREEDOM SYSTEM 8

Introduction- Free vibration of Undamped and damped system. Torsional system-Spring coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration with harmonic Excitation – Dynamic Vibration Absorber – Torsional Vibration Absorber-Vibration control.

UNIT III MULTI-DEGREE FREEDOM SYSTEM 8

Longitudinal, Transverse, Torsional systems, Geared systems Complexities - Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – Orthogonal properties – Energy methods of Rayleigh, Ritz and Dunkerley

UNIT IV EXPERIMENTAL VIBRATION ANALYSIS 10

Need for the experimental methods in Vibration analysis. Vibration Measuring Devices: seismometer, accelerometer and velometers-Vibration exciters: mechanical, hydraulic, electromagnetic and electrodynamic – Frequency measuring instruments: single reed, multi reed and stroboscope. Vibration meters and sound level meter. Signal conditioning devices: Filters, Amplifiers, Modulators/Demodulators, ADC/DAC. Signal analysis devices. Vibration recording and display devices. Experimental modal analysis. System Identification from frequency response

UNIT V ENGINEERING NOISE AND ITS CONTROL 10

Introduction-Sound Power, Sound Intensity and Sound pressure level. Sound spectra. The decibel scale-Decibel addition, subtraction and averaging- Loudness, Weighting networks, Equivalent sound level. Noise: Effects, Ratings and Regulations. Noise: Sources, Isolation and control-Industrial noise sources-Industrial noise control strategies-Noise control at the source, along the path and at the receiver.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ambekar.A.G. “Mechanical Vibrations and Noise Engineering”, Prentice Hall of India, New Delhi,2006
2. Rao, S.S.,” Mechanical Vibrations,” Addison Wesley Longman, 1995.

REFERENCES:

1. Thomson, W.T. – “Theory of Vibration with Applications”, CBS Publishers and Distributors, New Delhi, 1990.
2. Den Hartog, J.P, “Mechanical Vibrations,” Dover Publications, 1990.
3. Ramamurti. V, “Mechanical Vibration Practice with Basic Theory”, Narosa, New Delhi, 2000.

PTME9025 DESIGN FOR MANUFACTURING L T P C
3 0 0 3

AIM: To give exposure to interrelation between design and manufacture.

OBJECTIVES:

- To understand the principles of design such the manufacturing of the product is possible.
- Various design aspects to be considered for manufacturing the products using different processes.

UNIT I DESIGN FOR MANUFACTURING APPROACH AND PROCESS 9

Methodologies and tools, design axioms, design for assembly and evaluation, minimum part assessment. Taguchi method, robustness assessment, manufacturing process rules, designer's tool kit, Computer Aided group Technology, failure mode effective analysis, Value Analysis. Design for minimum number of parts, development of modular design, minimizing part variations, design of parts to be multi-functional, multi-use, ease of fabrication, Poka Yoke principles.

UNIT II GEOMETRIC ANALYSIS **9**

Surface finish, review of relationship between attainable tolerance grades and difference machining processes. Analysis of tapers, screw threads, applying probability to tolerances.

UNIT III FORM DESIGN OF CASTINGS AND WELDMENTS **9**

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols.

UNIT IV MECHANICAL ASSEMBLY **9**

Selective assembly, deciding the number of groups, control of axial play, examples, grouped datum systems - different types, geometric analysis and applications - design features to facilitate automated assembly.

UNIT V TRUE POSITION THEORY **9**

Virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, examples. Operation sequence for typical shaft type of components. Preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Harry Peck, "Designing for Manufacture", Pitman Publications, 1983.
2. Matousek, "Engineering Design, - A Systematic Approach" - Blackie & Son Ltd., London, 1974.

REFERENCES:

1. Spotts M.F., "Dimensioning and Tolerance for Quantity Production, Prentice Hall Inc., 1983.
2. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc. New York Publications, 1967.
3. James G. Bralla, "Hand Book of Product Design for Manufacturing" McGraw Hill Publications, 1983.
4. Trucks H.E., "Design for Economic Production", Society of Manufacturing Engineers, michigan, 2nd edition, 1987.

PTME9026 GAS DYNAMICS AND JET PROPULSION **L T P C**
3 0 0 3

AIM:

To impart knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.

OBJECTIVE:

i) To understand the basic difference between incompressible and compressible flow.
ii) To understand the phenomenon of shock waves and its effect on flow.
iii) To gain some basic knowledge about jet propulsion and Rocket Propulsion.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS **6**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

UNIT II FLOW THROUGH DUCTS **9**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS **10**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

UNIT IV JET PROPULSION **10**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION **10**

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Anderson, J.D., Modern Compressible flow, McGraw Hill, 3rd Edition, 2003.
2. H. Cohen, G.E.C. Rogers & Saravanamutto, Gas Turbine Theory, Longman Group Ltd., 1980.
3. S.M. Yahya, fundamentals of Compressible Flow, New Age International (P) Limited, New Delhi, 1996.

REFERENCES :

1. P. Hill and C. Peterson, Mechanics and Thermodynamics of Propulsion, Addison – Wesley Publishing Company, 1992.
2. N.J. Zucrow, Aircraft and Missile Propulsion, vol.1 & II, John Wiley, 1975.
3. N.J. Zucrow, Principles of Jet Propulsion and Gas Turbines, John Wiley, New York, 1970
4. G.P. Sutton, Rocket Propulsion Elements, John wiley, 1986, New York.
5. A.H. Shapiro, Dynamics and Thermodynamics of Compressible fluid Flow, , John wiley, 1953, New York.
6. V. Ganesan, Gas Turbines, Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. PR.S.L. Somasundaram, Gas Dynamics and Jet Propulsions, New Age International Publishers, 1996.
8. V. Babu, Fundamentals of Gas Dynamics, ANE Books India, 2008.

PTME9027 MANAGEMENT SCIENCES L T P C
3 0 0 3

AIM:

To introduce the concepts in optimization of resources for industries

OBJECTIVES:

- To create an awareness about the optimization of resources.
- To understand and apply the operations research techniques in industrial operations.

UNIT I LINEAR PROGRAMMING PROBLEMS 9

OR-Definition - Phases – models, LP model – formulation - solutions: Graphical- simplex method, Duality in LP – Dual simplex method – Revised simplex method – Sensitivity analysis.

UNIT II TRANSPORTATION AND NETWORK MODELS 10

Transportation problems- Assignment problems – Traveling salesman problems, Project management: Network logic – Fulkerson's rule – AON diagram – CPM and PERT techniques, sequencing models.

UNIT III INVENTORY CONTROL 8

Types of inventory- Inventory cost – EOQ – Deterministic inventory problems – EOQ with price breaks – Stochastic inventory problems – Multi product problems – Systems of inventory control – Selective inventory control techniques.

UNIT IV QUEUING THEORY 9

Queuing system – Characteristics – symbols – Poisson process and exponential distribution – Single server queuing models – Multiserver queuing models, Simulation – Monte Carlo technique – Inventory & Queuing problems.

UNIT V DECISION MODELS 9

Theory of Games – Two person zero sum games – pure strategies – Mixed strategies – Principle of dominance – Graphical solutions – Algebraic solutions – LP solutions. Replacement models – types of failures – replacement of items: Efficiency deteriorates with time, sudden failures.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Wayne.L.Winston, Operations research applications and algorithms, 4th edition 2007, Thomson learning.
2. Hamdy.A.Taha, Operations research an introduction, 8th edition 2007, PHI / Pearson education.

REFERENCES:

1. G.Srinivasan, Operations research principles and applications, EEE 2007, PHI.
2. R.Pannerselvam, Operations research, 2nd edition 2007, PHI
3. Frederick. S. Hiller and Gerald.J.Lieberman, Operations research concepts and cases, 8th edition (SIE),TMH.
4. Ravindran, Phillips and Solberg, Operations research principles and practice, 2nd edition 2007, Wiley India.
5. J.K.Sharma, Operations research theory and aplications, 3rd edition 2007, Macmillan India.
6. Prem kumar Gupta and D.S.Hira, Problems in Operations research, S.Chand.

PTME9028 COMPOSITE MATERIALS AND MECHANICS L T P C
3 0 0 3

AIM:

To understand the fundamentals of mechanics and manufacturing methods of composites for its strength and design.

OBJECTIVES:

i) To understand the fundamentals of composite material strength and its mechanical behavior
ii) Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
iii) Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
iv) Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding–Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 5

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 8

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

REFERENCES:

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

PTME9029 AUTOMOBILE ENGINEERING L T P C
3 0 0 3

AIM:

Impartation of basic principles of Automotive Vehicular systems with suitable illustrations and numerical problems; also enlightenment of development trends.

OBJECTIVE:

To provide a comprehensive view of automobile engineering to the students.

PREREQUISITE :

Other branch students may be offered this course without any preconditions. However, a orientation programme lasting a duration of 10 hours may be offered on selected topics like thermodynamics and vehicle mechanics.

UNIT I INTRODUCTION 5

Basic layouts of automotive vehicles including electric and hybrid electric systems, specifications and performance parameters of vehicles. Types of vehicle bodies.

UNIT II PROPULSIVE SYSTEMS 10

Reciprocating engine systems, Rotary engine systems, Electric motors, Hybrid systems, Gas turbine systems. Development trends like GDI and HCCI engine systems, complex hybrid electric systems, closed loop controls in piston engine systems, Alternate Fuel systems for propulsion engines. Vehicular pollutants emission and their controls. Three Way Catalytic converter features. Electronic Engine Management systems.

UNIT III TRANSMISSION SYSTEM 10

Clutches, gear boxes (manual and automatic), propeller shafting, differential and rear axle.

UNIT IV AUTOMOTIVE SAFETY HANDLING AND COMFORT SYSTEMS 10

Braking System, Steering System, Suspension system, Electrical system, Safety systems, HVAC system.

UNIT V TESTING AND SERVICING OF AUTOMOBILES **10**

A brief discussion on the following:
Engine Tuning
Chassis Dynamometry
Tests for emissions of pollutants like HC, CO, NOx and particulates
Wind tunnel testing of vehicles
Crash Testing
Modern garage equipments

TOTAL : 45 PERIODS

TEXT BOOK:

1. Automotive Mechanics, William H Crouse and Donald L. Anglin, Tata McGraw Hill Publishing Company Ltd., 2004, Tenth Edition.

REFERENCES:

1. Automotive Handbook, Bosch, Robert Bosch GmbH, Germany 2004, Sixth Edition.
2. Automotive Technology – A Systems Approach, Jack Erjavek, Thomson Learning, 3rd Edition, 1999.

PTME9030 INDUSTRIAL TRIBOLOGY L T P C
3 0 0 3

AIM:

To expose the students in the area of friction, wear and lubrication.

OBJECTIVE:

1. To teach the basics of friction mechanisms and materials selection based on friction behavior.
2. To teach the design principles involved in the design of various types of bearings.

UNIT I SURFACES AND FRICTION **9**

Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction – Adhesion-Ploughing- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.

UNIT II WEAR **9**

Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III LUBRICANTS AND LUBRICATION TYPES **9**

Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication- Hydrostatic Lubrication.

UNIT IV FILM LUBRICATION THEORY **9**

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS **9**

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTAL : 45 PERIODS

TEXT BOOK:

1. A.Harnoy " Bearing Design in Machinery "Marcel Dekker Inc, New York, 2003.

REFERENCES:

1. M.M.Khonsari & E.R.Booser, " Applied Tribology",John Willey &Sons,New York,2001
2. E.P.Bowden and Tabor.D., " Friction and Lubrication ", Heinemann EducationalBooks Ltd., 1974.
3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1995.

PTME9031 TURBO MACHINERY L T P C
3 0 0 3

AIM:

To teach and train the students in the filed of Turbo machinery and its applications.

OBJECTIVE:

To understand the various systems, principles, operations and applications of different types of turbo machinery components.

UNIT I PRINCIPLES 9

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Types- stage and design parameters-flow analysis in impeller blades-volute and diffusers, losses, characteristic curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR 9

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

UNIT IV AXIAL FLOW COMPRESSOR 9

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work done simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES 9

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

TOTAL 45 PERIODS

TEXT BOOK:

1. Yahya, S.H., Turbines, Compressor and Fans, Tata McGraw Hill Publishing Company, 1996.

REFERENCES:

1. Bruneck, Fans, Pergamom Press, 1973.
2. Earl Logan, Jr., Hand book of Turbomachinery, Marcel Dekker Inc., 1992.
3. Dixon, S.I., Fluid Mechanics and Thermodynamics of Turbomachinery, Pergamon Press, 1990.
4. Shepherd, D.G., Principles of Turbomachinery, Macmillan, 1969.
5. Stepanpff, A.J., Blowers and Pumps, John Wiley and Sons Inc. 1965.
6. Ganesan, V., Gas Turbines, Tata McGraw Hill Pub. Co., 1999.
7. Gopalakrishnan .G and Prithvi Raj .D, A Treatise on Turbomachines, Scifech Publications (India) Pvt. Ltd., 2002.

PTME9032 COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

AIM:

To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.

OBJECTIVE:

To introduce Governing Equations of vicous fluid flows

i) To introduce numerical modeling and its role in the field of fluid flow and heat transfer
ii) To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
iii) To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

PREREQUISITE : Fundamental Knowledge of partial differential equations, Heat Transfer and Fluid Mechanics

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE METHOD 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9

Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V CALCULATION FLOW FIELD BY FVM **9**

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models

TOTAL : 45 PERIODS

TEXT BOOKS:

1. T.J. Chung, Computational Fluid Dynamics, Cambridge University, Press, 2002.
2. Versteeg, H.K., and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The finite volume Method, Longman, 1998.
3. Ghoshdastidar , P.S., computer Simulation of flow and heat transfer, Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES:

1. Patankar, S.V. Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 2004.
2. Muralidhar, K., and Sundararajan, T., computationsl Fluid Flow and Heat Transfer, Narosa Publishing House, NewDelhi, 1995.
3. Ghoshdastidar P.S., Heat Transfer, Oxford Unversity Press, 2005.
4. Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.

PTME9033 MICRO ELECTRO MECHANICAL SYSTEM L T P C
3 0 0 3

AIM:

To understand the diverse technological and functional approaches and applications and provides an insight of micro sensors, actuators and micro fluidics.

OBJECTIVE:

On completion of the course, the students will be able to**:** Become familiar with micro fabrication techniques Assess whether using a MEMS based solution is the relevant and best approach Select the most suitable manufacturing processes and strategies for micro fabrication.

UNIT I INTRODUCTION TO MICROSYSTEMS **9**

Review of microelectronics manufacture and introduction to MEMS Overview of Microsystems technology. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT II MICRO MANUFACTURING TECHNIQUES **9**

Photolithography, Film deposition, Etching processes, Bulk micro machining, silicon surface micro machining, LIGA process, Rapid micro product development.

UNIT III MICRO SENSORS AND MICRO ACTUATORS **9**

Energy conversion and force generation, Electromagnetic Actuators,Reluctance motors, piezoelectric actuators, bi-metal-actuator Friction and wear.

Transducer principles, Signal detection and signal processing, Mechanical and physical sensors, Acceleration sensor, pressure sensor, Sensor arrays.

UNIT IV INTRODUCTION TO MICRO / NANO FLUIDS **9**

Fundamentals of micro fluidics, Micro pump – introduction – Types – Mechanical Micro pump – Non Mechanical micro pumps, Actuating Principles, Design rules for micro pump – modeling and simulation, Verification and testing – Applications.

UNIT V MICROSYSTEMS DESIGN AND PACKAGING **9**

Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite.

Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS**.**

TOTAL : 45 PERIODS

TEXT BOOK:

Mohamed Gad – el – Hak , MEMS Handbook, CRC Press, 2002.

REFERENCES:

1. Sabrie Solomon, Sensors Handbook, Mc Graw Hill, 1998
2. Marc F Madou, Fundamentals of Micro Fabrication, CRC Press, 2nd Edition, 2002
3. Francis E.H. Tay and W.O.Choong , Micro fluidics and Bio mems application, IEEE Press New York, 1997.
4. Trimmer William S., Ed., Micromachanics and MEMS, IEEE Press New York, 1997.
5. Maluf, Nadim, An introduction to Micro electro mechanical Systems Engineering, AR Tech house, Boston 2000.

PTME9035 MEASUREMENT AND CONTROLS **L T P C**
3 0 0 3

AIM:

To educate student on measurement and control systems which are the essential components of manufacturing system

OBJECTIVE:

- To understand the principle and use of sensors for measurement of different prameters
- To understand the concept of feedback control systems and their applications.

UNIT I MEASUREMENTS **9**

General concepts – UNITs and standards – Measuring instruments – sensitivity, readability, range accuracy, precision – static and dynamic response – repeatability hysteresis – systematic and random errors – correction – calibration.

UNIT II INSTRUMENTS **9**

Transducer, Modifying (intermediate) and Terminal stages – Mechanical and electrical transducers – preamplifiers – charge amplifiers – filters – attenuaters – D' Arsonval – CRO – Oscillographs – records – micro processor based data logging, processing and output.

UNIT III PARAMETERS FOR MEASUREMENT 9

Dimension, displacement velocity, acceleration, impact – Force, torque, power – strain-pressure – humidity- temperature – flow-Time, frequency and phase angle – noise and sound level. Radio tracer techniques – Flow visualization – shadow-graph inter-ferometer, Schlieren, Laser doppler anemometer.

UNIT IV AUTOMATIC CONTROL SYSTEMS 9

Basic elements – feedback principle implication of measurements – Error detectors – final actuating elements – Two position, multiposition, floating, pro-portional controls – relays – servo amplifiers – servo motors – mechanical, Electrical, magnetic, electronic, hydraulic, pneumatic systems.

UNIT V APPLICATION OF CONTROL SYSTEMS 9

Governing of speed kinetic and process control – pressure, temperature, fluid level, flow-thrust and flight control – photo electric controls.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. E.O.Doeblin, “Measurement Systems, Application and Design”, Mc Graw Hill Int. Edition, 4th Ed., 1990.
2. I.J.Nagarath and M.Gopal, “Control Systems Engineering”, John wiley & Sons, 2nd Ed., Ch.1-4, 1982.

REFERENCES:

1. J.P.Holman and N.J.Gajda Jr., “Experimental Methods for Engineers”, Mc Graw Hill Int. Edition, 5th Ed., 1989.
2. T.G.Beckwith and N.L.Buck, “Mechanical Measurements”, Addision Wesley Pub, Co., 1969.
3. W.H.Bureau, “What the printer should know about paper”, GATF, 1983.
4. J.P.Casey, “Ed. Pulp and Paper, Chemistry & Chemical Technology”, Vol. Wiley-Interscience Publication, 1981.

PTME9036 ADVANCED INTERNAL COMBUSTION ENGINEERING L T P C
3 0 0 3

AIM:

To impart the knowledge of advancements in the field of Internal Combustion Engines.

OBJECTIVE:

- To understand the underlying principles of operation in different IC Engines and components.
- To provide knowledge on pollutant formation, control, alternate fuel etc.,

UNIT I SPARK IGNITION ENGINES 9

Spark ignition Engine mixture requirements – Fuel and injection systems – Monopoint, Multipoint injection, Direct injection – Stages of combustion – Normal and Abnormal combustion – Factors affecting knock – combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel spray behaviour – spray structure and spray penetration – Air motion - introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL **9**

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, NOx, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS **9**

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits as fuels - Engine Modifications.

UNIT V RECENT TRENDS **9**

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – common Rail direct Injection Systems – Hybrid Electric vehicles – fuel Cells.

TOTAL :45 PERIODS

TEXT BOOK:

1. K.K. Ramalingam, Internal Combustion Engine Fundamentals, Scitech Publications, 2002.

REFERENCES:

1. R.B. Mathur and R.P. Sharma, Internal Combustion Engines.
2. V. Ganesan, Internal Combustion Engines, II Edition, TMH, 2002.
3. Duffy Smith, Auto Fuel Systems, The Good Heart Willox Company, Inc., 1987.

PTME9037 REFRIGERATION AND AIR CONDITIONING **L T P C**
3 0 0 3

AIM:

To inculcate the students with the knowledge of Refrigeration and Air conditioning

OBJECTIVES:

- To understand the underlying principles of operation in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning Systems

UNIT I REFRIGERATION CYCLE **7**

Review of thermodynamic principles of refrigeration. Concept of Air refrigeration system. Vapour compression refrigeration cycle - use of P.H charts - multistage and multiple evaporator systems - cascade system - COP comparison.

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING **10**

Compressors - reciprocating & rotary (elementary treatment) - condensers - evaporators cooling towers. Refrigerants - properties - selection of refrigerants, Alternate Refrigerants, Cycling controls.

UNIT III PSYCHROMETRY **10**

Psychrometric processes use of psychrometric charts - Grand and Room Sensible Heat Factors - bypass factor - air washers, requirements of comfort air conditioning, Summer and Winter Air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS 9

Cooling load calculation working principles of - Centralised Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES 9

Vapor Absorption system –Ejector jet , Steam jet refrigeration, Thermo electric refrigeration.APPLICATIONS - ice plant - food storage plants - milk - chilling plants.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Manohar Prasad, " Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983
2. Arora C.P., " Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 1988.

REFERENCES:

1. Roy. J. Dossat, " Principles of Refrigeration", Pearson Education 1997
2. Jordon and Priester, " Refrigeration and Air Conditioning", Prentice Hall of India PVT Ltd., New Delhi, 1985.
3. Stoecker N.F and Jones, " Refrigeration and Air Conditioning", TMH, New Delhi, 1981.

PTME9038 NUCLEAR ENGINEERING L T P C
3 0 0 3

AIM:

To impart fundamental knowledge of nuclear power plants

OBJECTIVE:

To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.

UNIT I NUCLEAR PHYSICS 9

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

UNIT II NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

UNIT III REPROCESSING 9

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

UNIT IV NUCLEAR REACTOR 9

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

UNIT V SAFETY AND DISPOSAL **9**

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Thomas J.Cannoly, "Fundamentals of nuclear Engineering" John Wiley 1978.

REFERENCES:

1. Collier J.G., and Hewitt G.F, "Introduction to Nuclear power", Hemisphere publishing, New York. 1987
2. Wakil M.M.El., "Power Plant Technology" – McGraw-Hill International, 1984.

PTME9039 DESIGN OF HEAT EXCHANGERS **L T P C**
3 0 0 3

AIM:

To build up necessary background for the design of various types of heat exchangers.

OBJECTIVE:

To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.

UNIT I DIFFERENT CLASSIFICATION OF HEAT EXCHANGERS **9**

Parallel flow, counter flow and cross flow; shell and tube and plate type; single pass and multipass; once through steam generators etc;

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS **9**

Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III MECHANICAL DESIGN OF SHELL AND TUBE TYPE **9**

Thickness calculation, Tubesheet design using TEMA formula, concept of equivalent plate for analysing perforated analysis, flow induced vibration risks including acoustic issues and remedies, tube to tubesheet joint design, buckling of tubes, thermal stresses

UNIT IV COMPACT AND PLATE HEAT EXCHANGER **9**

Types – Merits and Demerits – Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations

UNIT V CONDENSORS AND COOLING TOWERS **9**

Design of surface and evaporative condensers – cooling tower –performance characteristics

TOTAL : 45 PERIODS

TEXT BOOK:

1. T.Taborek, G.F.Hewitt and N.Afgan, Heat Exchangers, Theory and Practice, McGraw Hill Book Co.1980.

REFERENCES:

1. Walker, Industrial Heat Exchangers- A Basic Guide, Mc Graw Hill Book Co. 1980
2. Nicholas Cheremistoff, Cooling Tower, Ann Arbor Science Pub 1981
3. Arthur, P. Frass, Heat Exchanger Design, John Wiley and Sons, 1988
4. J.P. Gupta, Fundamentals of heat exchangers and pressure vessel technology, Hemisphere publishing corporation, Springer-Verlag (outside NA), 1986
5. Donald Q. Kern and Alban D. Kraus, "Extended surface hear transfer" Mc Graw Hill Book Co., 1972
6. E.A.D. Sanders, Heat Exchangers, Selection Design and Construction Layman Scientific & Technical; co published with John Wiley & sons, 1988

PTGE9021 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES:

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

PTGE9023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

UNIT I INTRODUCTION 10

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES 10

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology,Nanometer Structure”, Theory, Modeling and Simulations”, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTMF9302 THEORY OF METAL FORMING L T P C
3 0 0 3

AIM:
To learn the basics involved in the mechanism of plastic deformation during metal forming process.

OBJECTIVE:
This course aims to impart the knowledge about various metal forming processes. It deals with metal forming concepts like theory of plasticity and special metal forming techniques. After this course a student will have a good exposure about this subject. This also gives the recent trends in the metal forming processes.

UNIT I THEORY OF PLASTICITY 9
Theory of plastic deformation – Engineering stress and strain relationship – Strees tensor – Strain tensor – Yield criteria – Plastic stress strain relationship – Plastic work.

UNIT II CONSTITUTIVE RELATIONSHIPS AND INSTABILITY 7
Uniaxial tension test – Mechanical properties – Work hardening, Compression test, bulge test, plane strain compression stress, plastic instability in uniaxial tension stress, plastic instability in biaxial tension stress

UNIT III ANALYSIS OF METAL FORMING 12
Slab analysis – Slip line method, upper bound solutions, numerical methods, contact problems, effect of friction, thermo elastic- Elasto plasticity, elasto visco plasticity – analysis of forging, rolling, extrusion and wire drawing processes- Cold and Hot Forging

UNIT IV SHEET METAL FORMING 8
Sheet Metal Forming methods – Bending – Drawing – Deep Drawing – Stretch Forming – Tooling and applications – Analysis of Sheet Metal Forming – HERF Techniques – Principles and Process Parameters – Superplastic Forming.

UNIT V SPECIAL METAL FORMING PROCESSES 9
Orbital forging, Isothermal forging, Warm forging, Hot and Cold isotrophical pressing, high speed extrusion, rubber pad forming, micro blanking – Overview of Powder Metal Techniques – Powder rolling.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dieter G.E , " Mechanical Metallurgy" Mc Graw – Hill Co. S1. Edition 1995
2. Nagpal G.R "Metal Forming Process", Kanna Pub, New Delhi – 2000.

REFFERENCES:

1. Wagoner, R.H and Chenot, JJ Metal Forming Analysis, Cambridge University Press, 2002.
2. Slater, R.A.C., Engineering Plasticity – Theory and Applications to Metal Forming, John Wiely and Sons, 1987.
3. Shiro Kobayshi, Altan. T, Metal Forming and Finite Element Method, Oxford University Press, 1989.
4. Hosford, W.F and Caddell, R.M., Metal Forming Mechanics and Metallurgy, Prentice Hall Eaglewood Cliffs, 1993.
5. Narayanaswamy. R, Theory of Metal Forming and Plasticity Narosa Publishers, 1999.

PTME9042 FLEXIBLE MANUFACTURING SYSTEMS L T P C
3 0 0 3

UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS 9

Introduction – Single product, N-product, single batch, N-Batch scheduling problem – Modeling of N operations in M machines – Knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS 10

Introduction – Composition of FMS – Hierarchy of computer control – Computer control of work center and assembly lines – FMS supervising computer control. Types of software – specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE 10

Application of simulation – Model of an FMS – Simulation software – limitation. Manufacturing data systems – Data flow – CAD/CAM considerations in planning the FMS data base – FMS database systems – Planning for FMS database.

UNITIV GROUP TECHNOLOGY AND FMS 9

Introduction – matrix formulation – Mathematical Programming formulation – Graph Formulation – Knowledge based system for group technology. Application of possibility distributions in FMS systems justification.

UNIT V FACTORY OF THE FUTURE 7

FMS application in aerospace machining, sheet metal fabrication and prismatic component production. FMS development towards factories of the future – Artificial intelligence and Expert systems in FMS – Design Philosophy and Characteristics for Future.

TOTAL = 45 PERIODS

TEXT BOOK:

1. MIKELL P.GROOVER, automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 1989.

REFERENCES:

1. NAND JHA.K., Handbook of Flexible Manufacturing Systems, Academic Press Inc., 1991.

PTMG9072 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

AIM:
To provide an understanding of the scope of an entrepreneur.

OBJECTIVE:
To develop confidence on financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP 9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Entrepreneurial skills - Self Rating, Business Game, Thematic Appreciation Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT / CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kurahko & Hodgetts, “ Enterprenuership – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

1. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala,” Enterprenuership theory at cross roads: paradigms and praxis” Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs” Publishers: Entrepreneurship Development” Institute of India, Ahmedabad, 1986.

PTMG9073 MARKETING MANAGEMENT L T P C
3 0 0 3

AIM:

This will enable a student to take up marketing as a professional career.

OBJECTIVE:

1. To study marketing management deals with newer concepts of marketing concepts.
2. To develop marketing concepts, segmentation, pricing, advertisement and strategic formulation.

UNIT I CONCEPTS IN MARKETING 9

Definition, Marketing Process, Dynamics, Needs, Wants and Demands, Marketing Concepts, Environment, Marketing Mix, Selling vs Marketing, Consumer Goods, Industrial Goods, Product

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, Demographic factors, Motives, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Product planning and Development, Product life cycle, Pricing objectives, Methods, Marketing research process and Introduction.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of a Marketing Plan, Strategy Formulation and the Marketing Process, Implementation, Portfolio Analysis, BCG, GEC Grids.

UNIT V ADVERTISING, SALES PROMOTION & DISTRIBUTION 9

Characteristics, Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling Propositions, Characteristics, Wholesaling, Retailing, Channel Design, Logistics, Modern Trends in Retailing, Web based marketing

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition 2007.
2. Philip Kolter & Keller, “Marketing Management”, Prentice Hall of India, XII edition, 2006.

REFERENCES:

1. Donald S. Tull and Hawkins, “Marketing Reasearch”, Prentice Hall of Inida-1997.
2. Philip Kotler and Gary Armstrong “Principles of Marketing” Prentice Hall of India, XII Edn, 2000.
3. Ramasamy and Nama kumari, “Marketing Environment: Planning, implementation and control the Indian context”, 1990.
4. Czinkota&Kotabe, “Marketing management”, Thomson learning, Indian edition 2007
5. Adrain palmer, “ Introduction to marketing theory and practice”, Oxford university press IE 2004.
6. Steven J.Skinner, “Marketing”, All India Publishers and Distributes Ltd. 1998.

PTML9402 NON DESTRUCTIVE MATERIALS EVALUATION L T P C
3 0 0 3

OBJECTIVE:
Study the most important Non Destructive Evaluation and Testing methods, theory and their industrial application.

UNIT I INTRODUCTION TO NON DESTRUCTIVE TESTING 7
Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Comparison of advantages and limitations of different NDT methods. Visual inspection

UNIT II SURFACE NDT, LIQUID PENETRANT (PT), MAGNETIC PARTICLE TESTING (MT) 8
PT: Physical Principals, Penetrant Systems, Applications.
MT: Magnetisation methods, evaluation of results.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) 10
Active and Passive Thermography, Application in flaw detection.
ET: Principles, permeability and conductivity, Testing for defects, material characterisation and sorting

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 10
Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction.

UNIT V RADIOGRAPHY (RT) 10
Principle, interaction of X-Ray with matter, imaging, film and film less techniques, Computed Radiography, Computed Tomography

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Prakash Ravi," Nondestructive Testing Techniques", New Age International Publishers, 1st edition, 2007
2. Paul E Mix," Introduction to nondestructive testing: a training guide", Wiley, 2nd edition New Jersey, 2005

REFERENCES:

1. Baldev Raj, B. Venkataraman, D. J. Varde, Nerulikar, "Practical Magnetic Particle Testing", Narosa Publishing House, 2007
2. Charles, J. Hellier," Handbook of nondestructive evaluation", McGraw Hill, New York 2001.
3. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

IE9023 PRODUCT DESIGN AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on principles and practices of product design considering the customer wants and needs.

UNIT I **9**

Product Development process – Product development organizations, Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs.

UNIT II **9**

Establishing the product specifications,– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically.

UNIT III **9**

Concept selection-Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

UNIT IV **9**

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for manufacturing- cost considerations, Impact of DFM decisions on other factors.

UNIT V **9**

Principles of prototyping – Planning for prototypes, economics of product development projects, Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Karal, T.Ulrich steven D.Eppinger, Product Design and Development, McGraw Hill, International Editions, 2003.

REFERENCES:

1. S.Rosenthal, Effective Product Design and Development, Irwin, 1992.
2. Charles Gevirtz Developing New products with TQM, McGraw Hill International Editions, 1994.

PTME9351 FINITE ELEMENT ANALYSIS L T P C
3 1 0 4

AIM:

- To appreciate the need for and applications of numerical techniques for solving problems in mechanical Engineering**.**

OBJECTIVE:

1) To introduce the concepts of Mathematical Modeling of Engineering Problems.
2) To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION 8+3

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 12+3

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors. Assembly of Matrices - solution of problems from solid mechanics and heat transfer- Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 10+3

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 7+3

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION AND MISCELLANEOUS TOPICS 8+3

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems –

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Seshu. P. “Textbook of Finite Element Analysis” Prentice Hall of India, 2003.
2. J.N. Reddy, “ Finite Element Method” Tata McGraw Hill, 2003.

REFERENCES:

1. Chandrupatla and Belegundu, “Introduction to Finite Elements in Engineering” PHI / Pearson Education, 2003.
2. Logan. D.L. “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
3. Cook R.D., Malkus. D.S. Plesha, ME., “Concepts and Applications of Finite Element Analysis”, John – Wiley Sons 2003.
4. S.S. Rao, “The Finite Element Method in Engineering “Butter worth Heinemann, 2001.

PTMG9362 INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

AIM:
To provide a clear understanding of basic management principles that leads to corporate building.

OBJECTIVE:
- To develop Industrial Management deals with not only functions of management but also organizational structure and dynamics.
- To develop modern concepts of Industrial Management

UNIT I INTRODUCTION 9
Technology Management - Definition – Functions – Evolution of Modern Management – Scientific Management Development of Management Thought. Approaches to the study of Management, Forms of Organization – Individual Ownership – Partnership – Joint Stock Companies – Co-operative Enterprises – Public Sector Undertakings, Corporate Frame Work – Share Holders – Board of Directors – Committees – Chief Executive – Line and Functional Managers, Constraints – Environmental – Financial – Legal – Trade Union

UNIT II FUNCTIONS OF MANAGEMENT 9
Planning – Nature and Purpose – OBJECTIVE:s – Strategies – Policies and Planning Premises – Decision Making – Organizing – Nature and Process – Premises – Departmentalization – Line and staff – Decentralization – Organizational culture, Staffing - selection and training – Placement – Performance appraisal – Career Strategy – Organizational Development. Leading – Managing human factor – Leadership – Communication, Controlling - Process of Controlling – Controlling techniques, productivity and operations management – Preventive control, Industrial Safety.

UNIT III ORGANIZATIONAL BEHAVIOUR 9
Definition – Organization – Managerial Role and functions – Organizational approaches, Individual behaviour – causes – Environmental Effect – Behaviour and Performance, Perception – Organizational Implications. Personality – Contributing factors – Dimension – Need Theories – Process Theories – Job Satisfaction, Learning and Behaviour – Learning Curves, Work Design and approaches.

UNIT IV GROUP DYNAMICS 9
Group Behaviour – Groups – Contributing factors – Group Norms, Communication – Process – Barriers to communication – Effective communication, leadership – formal and informal characteristics – Managerial Grid – Leadership styles – Group Decision Making – Leadership Role in Group Decision, Group Conflicts – Types –Causes – Conflict Resolution – Inter group relations and conflict, Organization centralization and decentralization – Formal and informal – Organizational Structures – Organizational Change and Development – Change Process – Resistance to Change – Culture and Ethics.

UNIT V MODERN CONCEPTS 9
Management by OBJECTIVE:s (MBO) –, Management by Exception (MBE), Strategic Management - Planning for Future direction – SWOT Analysis – Evolving development strategies, information technology in management – Decisions support system – Management Games – Business Process Re-engineering(BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective - Principles and Steps – Advantages and disadvantages

TEXT BOOK:

1. Herald Koontz and Heinz Weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 1980.

REFERENCES:

1. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt.. Ltd, 1994
2. Ties, AF, Stoner and R.Edward Freeman, 'Management' Prentice Hall of India Pvt. Ltd. New Delhi 110011, 1992
3. Joseph J, Massie, 'Essentials of Management' Prentice Hall of India Pvt. Ltd. 1985
4. M. Govindarajan and S. Natarajan, Principles of Management, Prentice Hall of India Pvt. Ltd. New Delhi 2007.