ANNA UNIVERSITY, CHENNAI-600 025

UNIVERSITY DEPARTMENTS

R-2013

B.E (PART-TIME) MANUFACTURING ENGINEERING

I – VII SEMESTERS CURRICULUM

SEMESTER I

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTMA8151	Applied Mathematics	3	0	0	3
PTPH8151	Engineering Physics	3	0	0	3
PTCY8152	Engineering Chemistry	3	0	0	3
PTGE8151	Computing Techniques	3	0	0	3
PTGE8153	Engineering Mechanics	3	0	0	3
	TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTCE8252	Strength of Materials	3	0	0	3
PTEC8251	Electronics Engineering	3	0	0	3
PTMA8252	Probability and Statistics	3	0	0	3
PTMF8201	Machine Tools and Processes	3	0	0	3
PTML8251	Engineering Materials and Metallurgy	3	0	0	3
	TOTAL	**15**	**0**	**0**	**15**

SEMESTER III

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTCE8251	Fluid Mechanics and Machinery	3	0	0	3
PTME8251	Mechanics of Machines	3	0	0	3
PTMF8301	Casting and Welding Technology	3	0	0	3
PTMF8302	Metal Forming and Powder Metallurgy	3	0	0	3
PTMF8303	Thermodynamics	3	0	0	3
	TOTAL	**15**	**0**	**0**	**15**

SEMESTER IV

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTME8351	Machine Design	3	0	0	3
PTME8451	Hydraulics and Pneumatics	3	0	0	3
PTMF8401	CNC Technology	3	0	0	3
PTMF8402	Metrology and Computer Aided Inspection	3	0	0	3
PRACTICAL					
PTMF8411	Metrology and Computer Aided Inspection Laboratory	0	0	3	2
	TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTME8551	Computer Aided Design	3	0	0	3
PTME8552	Finite Element Analysis	3	0	0	3
PTME8553	Industrial Management	3	0	0	3
PTME8554	Mechatronics	3	0	0	3
PRACTICAL					
PTMF8511	C.A.D. / C.A.M. Laboratory	0	0	3	2
	TOTAL	**12**	**0**	**3**	**14**

SEMESTER VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTMF8601	Computer Integrated production Management System	3	0	0	3
PTMF8651	Operations Research	3	0	0	3
PTMF8652	Process Planning and Cost Estimation	3	0	0	3
E1	Elective-I	3	0	0	3
E2	Elective-II	3	0	0	3
	TOTAL	**15**	**0**	**0**	**15**

SEMESTER VII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PTME8751	Design for Manufacturing	3	0	0	3
PTMF8751	Industrial Robotics	3	0	0	3
E3	Elective-III	3	0	0	3
PRACTICAL					
PTMF8711	Project Work	0	0	9	6
	TOTAL	**9**	**0**	**9**	**15**

TOTAL NUMBER OF CREDITS: 103

ELECTIVES

CODE NO.	COURSE TITLE	L	T	P	C
PTGE8251	Environmental Science and Engineering	3	0	0	3
PTMA8251	Numerical Methods	3	0	0	3
PTME8071	Computational Fluid Dynamics	3	0	0	3
PTME8072	Design of Jigs, Fixtures and Press Tools	3	0	0	3
PTME8074	Entrepreneurship Development	3	0	0	3
PTMF8001	Electronic Materials and Processing	3	0	0	3
PTMF8002	Green Electronics Manufacturing	3	0	0	3
PTMF8003	Nano Coating	3	0	0	3
PTMF8004	Non Destructive Evaluation	3	0	0	3
PTMF8005	Precision Engineering	3	0	0	3
PTMF8006	Processing of Plastics and Composite Materials	3	0	0	3
PTMF8007	Quality Control and Reliability Engineering	3	0	0	3
PTMF8008	Sensors and Control Systems in Manufacturing	3	0	0	3
PTMF8009	System simulation	3	0	0	3
PTMF8010	Theory of Metal Cutting	3	0	0	3
PTMF8011	Value Engineering and Reengineering	3	0	0	3
PTMF8071	Additive Manufacturing Technology	3	0	0	3
PTMF8072	Electronics Manufacturing Technology	3	0	0	3
PTMF8073	Flexible Manufacturing Systems	3	0	0	3
PTMF8074	MEMS and Micro System Fabrication	3	0	0	3
PTMF8075	Nanotechnology	3	0	0	3
PTMF8076	Product Design and Development	3	0	0	3

PTMF8077	Total Productive Maintenance	3	0	0	3
PTMG8651	Total Quality Management	3	0	0	3
PTPR8071	Engineering Economics and Financial Management	3	0	0	3
PTPR8072	Surface Engineering	3	0	0	3
PTPR8551	Production of Automotive Components	3	0	0	3
PTGE8071	Disaster Management	3	0	0	3
PTGE8072	Human Rights	3	0	0	3

PTMA8151 APPLIED MATHEMATICS L T P C
(Common to all branches of B.E / B.Tech (PT) Programmes) 3 0 0 3

OBJECTIVES

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

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.

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 –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL: 45 PERIODS

OUTCOMES

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

BOOKS FOR STUDY

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Forty Second Edition, Delhi, 2012.
2. Ramana, B.V. Higher Engineering Mathematics" Tata McGraw Hill Publishing Company, 2008.

REFERENCES

1. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fouth Edition, 2011.
2. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt. Ltd., New Delhi, 2007.

PTPH8151 ENGINEERING PHYSICS L T P C
3 0 0 3

OBJECTIVE:

To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production – magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS 9

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications,2003.
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd, 2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

REFERENCES:

1. Sankar, B.N., Pillai.S.O., Engineering Physics, New Age International (P) Ltd., 2007.
2. Rajendran.V Engineering Physics, Tata McGraw-Hill, 2009.

PTCY8152 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To understand about the chemical thermodynamics.
- To impart knowledge in the basics of polymer chemistry.
- To develop sound knowledge on kinetics and catalysis.
- To impart basic knowledge on photochemistry and spectroscopy

UNIT I CHEMICAL THERMODYNAMICS 9

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Criteria of spontaneity; Helmholtz and Gibbs free energy functions; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure

UNIT II POLYMER CHEMISTRY 9

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS 9

Introduction-reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second, and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational

and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

1. P. Kannan and A. Ravikrishnan, “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India, 2011

REFERENCE BOOKS:

1. P.W. Atkins and de Paula Julio, “Physical Chemistry”, Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, “Fundamental of Photochemistry” New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, “Polymer Science”, New Age International P (Ltd.,), Chennai, 2006

PTGE8151 COMPUTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION 9

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS 9

Problem formulation – Problem Solving - Introduction to ‘ C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data

Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS 9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS:

1. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, " Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

PTGE8153 ENGINEERING MECHANICS L T P C

3 0 0 3

OBJECTIVE

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

UNIT I BASICS AND STATICS OF PARTICLES 9

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces –– Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports –Action and reaction forces –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 – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids 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 laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R. "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education (2010).
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2006)
3. J.L.Meriam and L.G.Kraige, " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,(1993)
4. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics Statics and Dynamics",3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, (1998).
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008)

PTCE8252 STRENGTH OF MATERIALS L T P C

(Common to Manufacturing, Mechanical, Industrial and Printing) 3 0 0 3

OBJECTIVE:

- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumertric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

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 9

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, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – 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 and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theory – Application of theories of failure.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

1. Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
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, 2001
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. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole Mechanics of Materials, Tata Mcgraw Hill publishing 'co. Ltd., New Delhi.

PTEC8251 ELECTRONICS ENGINEERING L T P C
(Common to Manufacturing, Mechanical, Industrial and Printing) 3 0 0 3

OBJECTIVE:

- To provide knowledge in the basic concepts of Electronics Engineering including semiconductors, transistors, electronic devices, signal generators and digital electronics.

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy band theory, Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Half and Full wave rectifiers, Zener effect, Zener diode, Zener diode Characteristics, Zener diode as a regulator.

UNIT II TRANSISTOR AND AMPLIFIERS 9

Bipolar junction transistors – CB, CE, CC configurations and characteristics, Biasing circuits – Fixed bias, Voltage divider bias, CE amplifier, Concept of feedback, Negative feedback, voltage series feedback amplifier, Current series feedback amplifier.

UNIT III FET AND POWER ELECTRONIC DEVICES 9

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

UNIT IV SIGNAL GENERATORS AND LINEAR ICs 9

Positive feedback, Sinusoidal oscillators – RC phase shift, Hartley, Colpitts, Wein bridge oscillators, Operational amplifier – Adder, Inverting and Non-inverting amplifiers, integrator and differentiator, IC 555 based Astable and Monostable Multivibrators.

UNIT V DIGITAL ELECTRONICS 9

Boolean algebra, Logic Gates, , Half and Full adders, Decoder, Encoder, Multiplexer, Demultiplexer, Flip flops, Digital to Analog converters - R-2R and weighted resistor types, Analog to Digital converters - Successive approximation and Flash types.

TOTAL:45 PERIODS

OUTCOMES:

- Upon Completion of this subject, the students can able to explain semiconductor, amplifier, electronic devices, signal generators and application of digital electronics.

TEXT BOOK:

1. Malvino, ‘Electronic Principles’, McGraw Book Co., 1993.

REFERENCES:

1. Grob. B and Schultz. M.E. ‘Basic Electronics’, Tata Mcgraw Hill, 2003.
2. Thomas L. Floyd, ‘Electronics Devices’, Pearson Education, 2002.
3. Thomas L. Floyd, ‘Digital Fundamentals’, Pearson Education, 2003.
4. Millman, Halkias Jacob, Jit Christos and Satyabrata, ‘Electronic devices and Circuits’, Tata McGraw Hill, 2nd Edition.

PTMA8252 PROBABILITY AND STATISTICS L T P C
(Common to EEE, Textile, Mechanical, Industrial, Printing and Manufacturing) 3 0 0 3

OBJECTIVES:

- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 9+3

Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9+3

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – $\chi 2$-test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS 9+3

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design - Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES :

After successfully completing the course, students should be able to do the following:

- Use statistical methodology and tools in the engineering problem-solving process.
- Compute and interpret descriptive statistics using numerical and graphical techniques.
- Understand the basic concepts of probability, random variables, probability distribution, and joint probability distribution.
- Compute point estimation of parameters, explain sampling distributions, and understand the central limit theorem.

TEXT BOOKS:

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", TataMcGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES:

1. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, New Delhi, 7th Edition, 2008.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

3. Ross, S.M., “Introduction to Probability and Statistics for Engineers and Scientists”, Elsevier, New Delhi, 3rd Edition, 2004.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., “Schaum’s Outline of Theory and Problems of Probability and Statistics”, Tata McGraw Hill, New Delhi, 2004.

PTMF8201 MACHINE TOOLS AND PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To identify the necessity of “manufacturing” Define with examples the concept of manufacturing, Machine tools and machining. State with examples the main requirements for “machining” List the main classifications of the manufacturing processes with examples.

UNIT I FUNDAMENTALS OF METAL CUTTING 10

Mechanics of orthogonal and oblique cutting-Mechanics of chip formation-Types of chips produced in cutting- Cutting forces and power-Temperature in cutting-Tool life –numerical problems-Wear and failure-surface finish and integ rity- Machine tools structures-Vibration and chatters in machining-machining economics - Cutting tools steels, cobalt alloys, coated tools -Diamond tools -Cutting fluids.

UNIT II MACHINE TOOLS AND PROCESSES FOR PRODUCING ROUND SHAPES 8

Turning parameters-lathes and Lathe operations- -Cutting screw threads-Boring and boring machines-Drilling and drills-Drilling machines-reaming and reamers-tapping and taps-Design considerations for drilling, reaming and tapping- Capstan and Turret lathe-single spindle and multi spindle automats-Swiss type and automatic screw machines.

UNIT III MACHINE TOOLS AND PROCESSES FOR PRODUCING VARIOUS SHAPES 8

Milling operations-Milling machines-Planning and shaping-Broaching and broaching machines-Sawing-filing and finishing-gear manufactured by machining.

UNIT IV ABRASIVE MACHINING AND FINISHING OPERATIONS 8

Abrasives - bonded abrasives – grinding process- wheel gear grinding operations and machines - grinding fluids - Design Consideration for grinding - finishing operations-deburring - economics of grinding and finishing operation.

UNIT V MODERN MACHINING 11

High speed machining-Ultra precision Machining and Hard turning-Ultrasonic machining-Abrasive jet machining-Abrasive flow machining-Water jet machining -Electro chemical machining-Electric discharge machining-Wire Electric discharge machining-. Electron beam machining-Laser beam Machining.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- This domain knowledge will increase their employability skills
- Use this knowledge to develop innovative ideas in the areas of machine building, work holding and tool holding methods.
- Encourages to involve in research in the area of machining

TEXT BOOKS:

1. Sharma P.C., "A Text book of production Technology: manufacturing processes" S.Chand & Company Limited, 7th Edition (2007).
2. kalpakjian S. and SCHMID S., **"**Manufacturing Engineering and Technology", Prentice-Hall of India", 50th Edition (2006) , ISBN : 0131489658.

REFERENCES:

1. Krar S.F., "Technology of machine tools" McGraw-Hill, New York. (2011), 7th Edition
2. Brown J.A. "Modern manufacturing processes", Industrial Press Inc., ISBN 0831130342,9780831130343(1991).
3. Paul E.D., Black J.T. and Kosher R.A, "Materials and Processes in Manufacturing", Wiley, 9thEdition (2003), ISBN 0471033065.
4. Lindberg R.A., "Process and Materials of Manufactures" Prentice-Hall of India, Fourth Edition, ISBN 8131701034(1994).

PTML8251 ENGINEERING MATERIALS AND METALLURGY L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- 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 ALLOYS AND PHASE DIAGRAMS 10

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 11

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – 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- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys, special non-ferrous metals and alloys of low coefficient of the thermal expansion, high corrosion resistance, heat resistant etc.

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes) - Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites-Classifications- Matrix and reinforcement Materials-Applications of Composites-Nano composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 6

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use different materials, their processing, heat treatments in suitable application in mechanical engineering fields.

TEXT BOOK

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian edition 2007

REFERENCES

1. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt.Ltd., 1999.
2. Sydney H.Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994.
3. G.S. Upadhyay and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt.Ltd., New Delhi, 2006.

PTCE8251 FLUID MECHANICS AND MACHINERY L T P C
(Common to Mechanical and Manufacturing) 3 0 0 3

OBJECTIVES:

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 7

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 8

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 12

Impact of jets - Euler's equation - Theory of rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps – working principle - work done by the impeller - performance curves - Reciprocating pump - working principle – indicator diagram – work saved by fitting air vessels – Rotary pumps – classification – comparison of working principle with other pumps – advantages.

UNIT V TURBINES 10

Classification of turbines – heads and efficiencies – velocity triangles – axial, radial and mixed flow turbines – Pelton wheel and Francis turbine - working principles - work done by water on the runner – draft tube - specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOKS:

1. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co.(2010)
2. Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House(p) Ltd. New Delhi(2004)
3. Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House (2002), New Delhi

REFERENCE:

1. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", ISBN 978-0-470-54755-7, 2011.

PTME8251 MECHANICS OF MACHINES L T P C

(Common to Manufacturing, Industrial and Printing) 3 0 0 3

OBJECTIVES:

- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyze the forces and toques acting on simple mechanical systems
- To understand the importance of balancing and vibration.

UNIT I KINEMATIC OF MECHANICS 9

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT II GEARS AND GEAR TRAINS 9

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNIT III FRICTION IN MACHINE ELEMENTS 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.

UNIT IV FORCE ANALYSIS 9

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members.

UNIT V BALANCING AND VIBRATION 9

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOK:

1. Uicker J.J, Pennock G.R and Shigley J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.

REFERENCES:

1. Rattan S.S., "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.
2. Bevan T., "Theory of Machines', 3rd Edition, CBS Publishers and Distributors, 2005.
3. Cleghorn W. L, "Mechanisms of Machines", Oxford University Press, 2005
4. Benson H.T., "Principles of Vibrations", Oxford University Press, 2nd Edition, 2007
5. Robert L.N, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
6. Allen S.H Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
7. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines', Affiliated East-West Pvt. Ltd., New Delhi, 1988.
8. Rao J.S. and Dukkipati R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
9. Hannah J. and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
10. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
11. Thomson W.T., Dahleh M.D. and Padmanabhan C., "Theory of Vibration with Application", 5th edition Pearson Education, 2011
12. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
13. Khurmi. R.S., "Theory of Machines", 14th Edition, S Chand Publications.

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.

PTMF8301 CASTING AND WELDING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To study various casting and welding methods including advanced techniques, with emphasis on basic principles, limitations and application areas.

UNIT I CASTING INTRODUCTION 10

Patterns: making – materials, types, allowances for pattern- Moulding: materials, equipment, sand preparation, testing and control - cores and core making- Design considerations in casting, gating and Riser - Melting furnaces- directional solidification in castings, Metallurgical aspects of Casting- Steps involved in casting.

UNIT II CASTING PROCESSES 8

Casting processes: Steps, Advantages, limitations and applications of Sand castings, pressure die casting, permanent mould casting, centrifugal casting, precision investment casting, shell Moulding, CO_2 Moulding, continuous casting, squeeze casting, electro slag casting, Fettling and finishing, casting defects and Inspection.

UNIT III INTRODUCTION TO WELDING 9

Types of welding- Positions of welding-types of weld joints- -Arc welding: power sources-Electrodes-flux-Gas welding-equipment-Welding symbols –Metallurgical aspects of welding-weld thermal cycles- Heat affected zone and its characteristics-pre and post weld heat treatments -welding defects, causes and remedies-Welding inspection.

UNIT IV WELDING PROCESSES 10

Welding processes: Arc welding: SMAW, GTAW, GMAW, SAW, ESW-Resistance welding: spot, seam, projection, percussion, flash types-atomic hydrogen arc welding- thermit welding-oxy acetylene gas welding- Flame cutting: Oxyacetylene, arc cutting- Soldering, brazing and braze welding -Electron beam welding, laser beam welding, plasma arc welding and ultrasonic welding-explosive welding- Friction stir welding- Under water welding.

UNIT V AUTOMATION OF WELDING AND CASTING 8

Layout of mechanised foundry-sand reclamation-Material handling in foundry - pollution control in Foundry-Recent trends in casting-Computer Aided design of Castings-Process. Automation in welding-Welding robots- Seam tracking vision and arc sensing-Overview of automation of welding in aerospace, nuclear, surface transport vehicles.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course the students are expected

- To produce useful research output in welding and casting.
- Use this knowledge in advancing the welding and casting process.
- Application of design knowledge to understand and to overcome defects in welding and casting.

TEXT BOOKS:

1. Gowri S., Hariharan P. and Suresh Babu A., “Manufacturing Technology-I”, Pearson Education, 2008.
2. Little R.L., “Welding and Welding Technology”, Tata McGraw Hill, 2004.
3. Heine R., Loper C. and Rosenthal P., “Principles of Metal Casting”, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2001.
4. Parmer R.S., “Welding Processes& Technology”, Khanna Publishers, 2001.

REFERENCES:

1. Campbell J., “Casting Practice”, Elsevier Science Publishing Co., 2004.
2. Campbell J., “Casting", Butterworth Heinemann, 2003.
3. Jeffus L., “Welding: Principles and Applications", Delmar Publishers, 2004.
4. Cary H.B., “Modern Welding Technology”, Prentice Hall, 2002.
5. Weman K., “Welding Processes Handbook”, 2003.
6. Jeffus L., “Welding for Collision Repair”, Delmar Publishers, 1999.
7. ASM Hand Book, “Casting”, ASM International, 2008.

PTMF8302 METAL FORMING AND POWDER METALLURGY L T P C
3 0 0 3

OBJECTIVE:

- At the end of this course the student should be able to understand the principles, equipments to be used, applications, advantages, limitations and economics of various metal forming processes such as bulk forming, sheet metal, special forming and powder metallurgy forming.

UNIT I INTRODUCTION TO METAL FORMING 8

Mechanical behavior of materials – Elastic and plastic deformation - Classification of Forming Processes – Temperature in metal working: hot and cold working – Introduction to the theory of plastic deformation.

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES 10

Analysis of plastic deformation in forging, rolling, extrusion, rod/wire and tube drawing processes – Effect of friction, calculation of forces, work done, process parameters, equipments, defects and applications – Recent advances in forging, rolling, extrusion and drawing processes – Experimental techniques of evaluation of friction in metal forming – Economics of bulk forming processes.

UNIT III SHEET METAL FORMING PROCESSES 10

Conventional sheet metal forming processes like shearing, bending and miscellaneous forming processes – High energy rate forming processes – Superplastic forming processes – Deep drawing process; Principles, process parameters, advantages, limitations and applications– Formability of sheet metals – Design considerations.

UNIT IV SPECIAL FORMING PROCESSES 8

Orbital forging – Isothermal forging – Hot and cold Isostatic pressing – High speed extrusion – High speed forming machines – Rubber pad forming – Water hammer forming – Fine blanking.

UNIT V POWDER METALLURGY 9

Overview of powder metallurgy techniques, advantages and their applications – Powder forging, rolling, extrusion and drawing – Secondary and finishing operations – Design considerations for powder metallurgy– Economics of powder metallurgy processes.

TOTAL: 45 PERIODS

OUTCOME:

- At the end of the course the student will be able to apply and compare different metal forming concepts in bulk forming and sheet metal forming process.

TEXT BOOKS:

1. Kalpakjian S. and Schmid S.R., “Manufacturing Process”, Pearson, Chennai, 2009.
2. Dieter G.E. “Mechanical Metallurgy”, McGraw Hill, New Delhi, 1988.

REFERENCES:

1. Schuler, “Metal Forming Hand Book”, Springer Verlag, Berlin, 1998.
2. Hosford W.F. and Caddell R.M. “Metal Forming: Mechanics and Metallurgy”, Cambridge University press, Cambridge, 2011.
3. Narayanasamy R., “Theory of Metal Forming Plasticity”, Narosa Publishers, New Delhi, 1999.
4. Nagpal G.R.,“Metal Forming Processes”, Khanna Publishers, Delhi, 2000.
5. Altan T.S. and Gagel H.L. “Metal Forming: Fundamentals and Applications”, American Society of Metals, Metals Park, Ohio, 1983.
6. Juneja B.L., “Fundamentals of Metal forming Processes”, New Age International (P) Ltd., Chennai, 2007.
7. ASM Handbook Committee, ASM Metals Hand book: Forming and Forging (Volume - 14), ASM International, Metals’ Park, Ohio, 1996.

PTMF8303 THERMODYNAMICS L T P C
3 1 0 4

OBJECTIVES:

- To understand the basic laws of Thermodynamics and Heat transfer.
- To understand the principle of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc.

UNIT I BASIC CONCEPTS OF THERMODYNAMICS 12

Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Pure substances – Phase change processes of pure substances – Property diagrams – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

UNIT II FIRST AND SECOND LAW OF THERMODYNAMIC 12

First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility -Applications.

UNIT III HEAT ENGINES 15

Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine , Turbine Components - Refrigeration Cycle – Vapour Compression & Vapour Absorption System ,Gas Refrigeration System – Environmental friendly Refrigerants – Air Conditioning.

UNIT IV GASES AND VAPOUR MIXTURES 10

Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton’s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT V HEAT TRANSFER 11

Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thicknes Simple problems, fins convection – Free convection and forced convection – Flow over Flatplates and Flow through Pipes – Heat Exchangers - Radiation – Black Body, Grey Body Radiation.

TOTAL : 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to understand different gas power cycles and use of them in IC and R&AC applications.

TEXT BOOKS:

1. Cenegal Y.A. and Boles M.A., "Thermodynamics an Engineering Approach", Tata McGraw hill, Fourth edition, 2004.
2. Moran M.J. and Shapiro H.N., "Fundamentals of Engineering Thermodynamics" John wiley &Sons, Fourth Editon, 2000.

REFERENCE BOOKS:

1. Dhar P.L., "Engineering Thermodynamics – A Generalized Approach", Elsevier, 2008.
2. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice Hall of India, Second Edition,
3. Nag P.K., "Engineering Thermodynamics" ,Tata McGraw hill, Third edition, 2005

PTME8351 MACHINE DESIGN L T P C

(Common to Manufacturing and Industrial) 3 0 0 3

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 IN MACHINE MEMBERS 10

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 -Factor of safety - theories of failure – Design based on strength and stiffness.

UNIT II SHAFTS, COUPLINGS, JOINTS AND BEARINGS 8

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, key ways and splines –Rigid and flexible couplings.

Threaded fasteners, Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems)

UNIT III ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9

Various types of springs, optimization of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT IV DESIGN FOR FLEXIBLE ELEMENTS 9

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT V SPUR GEARS, HELICAL GEARS AND GEAR BOXES 9

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations.

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 for machine tool applications – Variable speed gear box.

TOTAL: 45 PERIODS

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

OUTCOMES:

- Upon completion of this course, the students can able to successfully design machine components

TEXT BOOK:

1. Bhandari V, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.

REFERENCES:

1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Joseph Shigley,Charles Mischke,Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill , 2008.
3. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”,4th Edition, Wiley, 2005
4. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill Book Co.(Schaum’s Outline), 2010
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, “Fundamentals of Machine Elements”, 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
7. Ansel Ugural, “Mechanical Design – An Integral Approach, 1st Edition, Tata McGraw-Hill Book Co, 2003.
8. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2003.

STANDARDS:

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

PTME8451 HYDRAULICS AND PNEUMATICS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

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 – Friction loss- Work, Power and Torque. Problems

Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II HYDRAULIC ACTUATORS AND VALVES 9

Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Servo and Proportional valves - Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols - Problems

UNIT III HYDRAULIC SYSTEMS 9

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

UNIT IV PNEUMATIC SYSTEMS 9

Properties of air– Perfect Gas Laws- Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit- cascade method- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Identify hydraulic and pneumatics components.
- Ability to design hydraulic and pneumatic circuits.

TEXT BOOK:

1. Anthony Esposito, "Fluid Power with Applications", Prentice Hall, 2009.

REFERENCES:

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. Dudelyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
6. Joji.P, “Pneumatic Controls”, Wiley India, 2008.

PTMF8401 CNC TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To Understand evolution and principle of CNC machine tools
- To Describe constructional features of CNC machine tools, drives and positional transducers used in CNC machine tools
- To Generate CNC programs for popular CNC controllers
- To Describe tooling and work holding devices for CNC machine tools

UNIT I INTRODUCTION TO CNC MACHINE TOOLS 6

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, types of control systems, CNC controllers, characteristics, interpolators, types of CNC Machines – turning centre, machining centre, grinding machine, EDM, Computer Aided Inspection,

UNIT II STRUCTURE OF CNC MACHINE TOOL 10

CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

UNIT III DRIVES AND CONTROLS 9

Spindle drives – DC motors, feed drives – stepper motor, servo principle, DC and AC servomotors, Linear motors Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.

UNIT IV CNC PROGRAMMING 11

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming,machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

UNIT V TOOLING AND WORK HOLDING DEVICES 9

Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification-qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, Tool for complete machining system, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- This domain knowledge will increase their employability skills
- Use this knowledge to program CNC machines

- Use this knowledge to organize production using CNC machines

TEXT BOOKS:

1. "Mechatronics" HMT, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Mike Mattson., "CNC Programming Principles and Applications", Delmar Cengage learning, 2010.

REFERENCE BOOKS:

1. Evans K., Polywka J. and Stanley Gabrel., "Programming of CNC Machines", Third Edition – Industrial Press Inc, New York, 2007
2. Madison J., "CNC Machining Hand Book", Industrial Press Inc., 1996.
3. Smid P., "CNC Programming Hand book", Industrial Press Inc., 2007 Third Edition
4. Jones B.L., "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P., "Computer Numerical Control Machines", New Central Book Agency, 2002.
6. Rao P.N., "CAD/CAM Principles and Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.

PTMF8402 METROLOGY AND COMPUTER AIDED INSPECTION L T P C
3 0 0 3

OBJECTIVE:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries. Expose the students to various modern metrological instruments, the procedure used to operate these instruments and applications of computers in metrology.

UNIT I BASIC CONCEPTS OF MEASUREMENTS 8

Need for measurement - Precision and Accuracy - Errors in Measurements - Causes– Types- Handling of measuring instruments- Maintenance of Instruments.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9

Measurement of Engineering Components - Comparators, Slip gauges, Rollers, Limitgauges - Design and Applications - Auto collimator - Angle dekkor – Alignment telescope - Sine bar - Bevel protractors - Types - Principle - Applications.

UNIT III FORM MEASUREMENTS 9

Measurement of Screw threads and gears - Radius measurement - Surface finish measurement - Straightness, Flatness and roundness measurements - Principles - Application – Computerized form measuring equipments.

UNIT IV LASER METROLOGY 10

Precision instrument based on Laser - Use of Lasers - Principle – Interference microscope - Laser Interferometer - Application in Linear and Angular measurements - Testing of machine tools using Laser Interferometer.

UNIT V COMPUTER AIDED INSPECTION AND ADVANCES IN METROLOGY 9

Co-ordinate Measuring Machines - Constructional features - Types - Applications of CMM - CNC CMM applications – Fundamentals of Computer Aided Inspection - Machine Vision and applications in Metrology – Introduction to Nanometrology.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course
The student will be able to:

- Understand various technical terms and perform measurement tasks accurately.
- Choose the right instrument and method of measurement for a particular application.
- Follow the right procedure for measurement of various components depending upon the applications.

TEXT BOOK:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 19th Edition, 2005.

REFERENCES:

1. Galyer J.F.W. and Shotbolt C.R., “Metrology for Engineers”, O.R.Cassel, London,1993.
2. Thomas, “Engineering Metrology”, Butthinson & Co., 1984.
3. Bewoor A.K. and Kulkarni V.A., “Metrology and Measurements”, Tata McGraw-Hill, 2009.
4. Whitehouse D.J., The Handbook of Surface and Nanometrology, CRC Press, 2011.

PTMF8411	METROLOGY AND COMPUTER AIDED INSPECTION LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- To make the students understand the fundamental principles of measuring techniques by practicing exercises on various measuring instruments.

LIST OF EXPERIMENTS:

1. Linear and Angular measurements using Autocollimator.
2. Measurement of tooth thickness using gear tooth Vernier calliper
3. Calibration of optical comparator and measurement of dimensions
4. Exercises in Digital Height Gauge.
5. Measurement of Taper Angle using sine bar.
6. Measurement of components using profile projectors.
7. Study Exercises in Video measuring system, Rolling gear tester, Surface Roughness Tester and CMMs.

TOTAL: 30 PERIODS

OUTCOME:

At the end of this course
The student will be able to:

- Understand various technical terms and perform measurement tasks accurately.
- Choose the right instrument and method of measurement for a particular application.
- Follow the right procedure for measurement of various components depending upon the applications.

PTME8551 COMPUTER AIDED DESIGN L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- To provide an overview of how computers are being used in design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle- 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

UNIT II GEOMETRIC MODELLING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves- Techniques for surface modelling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modelling techniques- CSG and B-rep

UNIT III VISUAL REALISM 9

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS 9

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library **(**OpenGL**)** - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

TEXT BOOK:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles, practice and manufacturing management “ (Second edition) -Pearson Education
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.
2. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc., 1992.
3. Foley, Wan Dam, Feiner and Hughes - Computer graphics principles & practice Pearson Education - 2003.

PTME8552 FINITE ELEMENT ANALYSIS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES

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

UNIT I INTRODUCTION 9

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 9

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 9

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 9

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 ADVANCED TOPICS 9

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 – Introduction to Analysis Software.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOK:

1. J.N.Reddy, “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005

REFERENCE BOOKS:

1. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
2. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
4. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butter worth Heinemann, 2004
5. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990

PTME8553 **INDUSTRIAL MANAGEMENT** **L T P C**
(Common to Manufacturing and Mechanical) **3 0 0 3**

OBJECTIVE:

- 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 – objectives – 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 inventory management systems-Tools of Techniques– Prevention control, industrial safety

UNIT III ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and functions – organizational approaches, individual behavior – causes – Environmental Effect – Behavior and performance, perception – organizational Implications. Personality – Contributing factors – Dimension – Need Theories – process Theories – Job satisfaction, Learning and Behavior- Learning Curves, work design and approaches

UNIT IV GROUP DYNAMICS 9

Group Behavior – 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, Organizational 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 objectives (MBO) – Strategic Management – SWOT analysis – Evolving development strategies, information technology in management – Decision support system – Management Games – Business Process Re-engineering (BPR) – supply chain management (SCM) –Global Perspective – Principles and Steps – Advantages and Disadvantages

TOTAL: 45 PERIODS

OUTCOMES:

- Students gain knowledge on the basic management principles to become management (s) professional.

TEXT BOOKS:

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

2. M.Govindarajan and S.Natarajan, Principles of Management, Prentice Hall of India Pvt.Ltd. New Delhi 2007

REFERENCE BOOKS:

1. S.Chandran, Organizational Behaviors, 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. Ltd. 1985

PTME8554 MECHATRONICS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- This syllabus is formed to impart knowledge for the students about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics.
Sensors and Transducers**:** Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II 8085 MICROPROCESSOR 8

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 10

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 7

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

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 8

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. 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

OUTCOMES:

- Upon completion of this course, the Students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , “Mechatronics Integrated Technologies for Intelligent Machines”,Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
5. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.

PTMF8511 CAD / CAM LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

1. 3D GEOMETRIC MODELLING 24 PERIODS

List of Experiments

1. Introduction of 3D Modelling software

Creation of 3D assembly model of following machine elements using 3D Modelling software

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

2. Manual Part Programming. 21 PERIODS

(i)Part Programming - CNC Machining Centre

a) Linear Cutting.

b) Circular cutting.

c) Cutter Radius Compensation.

d) Canned Cycle Operations.

(ii) Part Programming - CNC Turning Centre

a) Straight, Taper and Radius Turning.

b) Thread Cutting.

c) Rough and Finish Turning Cycle.

d) Drilling and Tapping Cycle.

3. **Computer Aided Part Programming**

e) CL Data and Post process generation using CAM packages.

f) Application of CAPP in Machining and Turning Centre.

4. **Study of CNC EDM, CNC EDM wire-cut and Rapid prototyping**.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- The student will be able to use CNC machines for production
- Use this knowledge to program CNC machines
- Use this knowledge for Robot and PLC programming

PTMF8601 COMPUTER INTEGRATED PRODUCTION MANAGEMENT SYSTEM

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OBJECTIVE:

- The course provides basic concepts of production planning and control, its bottlenecks, material requirement planning, shop floor control and different approaches to computer aided process planning in manufacturing sector.

UNIT I MANUFACTURING PLANNING AND CONTROL 10

Basic concepts – Types of production System - Functions of production planning and control – problems with Production Planning and Control – Computer Integrated Production Management System– Evolution of the MPC system-Demand management in MPC system and the MPC Environment: Make-to-stock, Assembly-to-order, Make- to –order, Engineer-to-order.

UNIT II FORECASTING 8

Forecasting system-Forecasting methods – Single and Double moving average methods – Single and Double exponential smoothing methods – Simple regression method of forecasting – Forecasting Errors.

UNIT III MATERIAL REQUIREMENT PLANNING 10

Basic MRP Concepts – Inputs to the MRP System – Master production Schedule – Bill of Materials, Inventory Record File – MRP Logic – Gross requirements, net requirements, lot sizing – Capacity Requirement Planning (CRP)-Distribution Resource Planning (DRP)-Manufacturing Resource Planning (MRP II).

UNIT IV COMPUTER AIDED PROCESS PLANNING 10

Need for process planning – Functions of process planning –Approaches to CAPP-Variant process planning – part family search – Generative method of CAPP – Forward and Backward planning – input format – part description methods – CAD Models – Decision Logic – Artificial Intelligence – Knowledge Representation – Databases and Algorithms – Expert Process Planning-Automatic Process Planning-Future trends-Case Studies.

UNIT V SHOP FLOOR CONTROL 7

Functions of shop floor control – Order Release-order scheduling – order progress – Automatic Identification System- Factory Data Collection system.

TOTAL: 45 PERIODS

OUTCOME

At the end of this course the students are expected

- To familiarize the students with computer application in various activities of manufacturing, production and control system.
- To apply appropriate principles and strategies of planning and control, forecasting, material requirement planning, process planning concepts and shop floor control into computer integrated manufacturing system.

TEXT BOOKS:

1. Groover M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2009.
2. Kant Vajpayee S., “Principles of Computer Integrated Manufacturing”, Prentice Hall of India, 2006.

REFERENCES:

1. Groover M.P. and Zimmers E.W., “CAD/CAM, Computer Aided Design and Manufacturing”, Prentice Hall of India, 2006.
2. Gideonha and Well R.D., “Principles of process planning”, Chapman and Hall, 1995.
3. Chand T.C., “Expert process planning for manufacturing”, Addison Wesley publishing company, 1990.

PTMF8651 OPERATIONS RESEARCH L T P C

(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution-Algebraic solution – Linear Programming solution – Replacement models – Models based on service life – Economic life – Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Taha H.A., “Operations Research”, Prentice Hall of India, 2003, Sixth Edition.

REFERENCE BOOKS

1. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Hillier and Libeberman, “Operations Research”, Holden Day, 1986.
5. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
6. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson – Asia 2002.

PTMF8652 PROCESS PLANNING AND COST ESTIMATION L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 10

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 10

Process parameters calculation for various production processes-Selection jigs and fixtures-selection of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 8

Importance of costing and estimation –methods of costing-elements of cost estimation – Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 8

Estimation of Different Types of Jobs - Estimation of Forging Shop , Estimation of Welding Shop ,Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling , Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course the students are expected to use

- This domain knowledge will increase their employability skills
- Use this knowledge to develop process planning for new products and making cost estimation.
- Creating database for the future use

TEXT BOOK:

1. Peter scalon, “Process planning, Design/Manufacture interface”, Elsevier science technology Books, Dec 2002.

REFERENCES:

1. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, John Wiley, 9th Edition, 1998.
2. Russell R.S and Tailor B.W, “Operations Management”, PHI, 4th Edition, 2003
3. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, PHI, 2nd Edition, 2002.

PTME8751 DESIGN FOR MANUFACTURING L T P C

(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

- To understand the principles of design such that the manufacturing of the product is possible.
- To educate students on various design aspects to be considered for manufacturing the products using different processes.

UNIT I MANUFACTURING METHODOLOGY AND PROCESESS 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 effects 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, Poke Yoke principles.

UNIT II GEOMETRIC ANALYSIS 9

Surface finish, review of relationship between attainable tolerance grades and different machining processes, part features-feature of size-control from-placement material condition – MMC – LMC

UNIT III FORM DESIGN OF CASTINGS AND WELDMENTS 9

Redesign of castings based on parting line considerations, minimizing corerequirements, redesigning cast members by welded structure , 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, Assembly analysis worst case Arithmetic method, Monte -Carlo method.

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

OUTCOMES

- Perform designing of components considering manufacture ability
- Ability to design casting and weld structures.
- Ability to use principles of design for assembly

TEXT BOOKS :

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

REFERENCE BOOKS:

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.

PTMF8751 INDUSTRIAL ROBOTICS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors

- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 6

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic-Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 12

Requirements of a sensor, Principles and Applications of the following types of sensors-Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 13

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 5

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
2. Groover M.P., “Industrial Robotics-Technology Programming and Applications”, McGraw Hill, 2001.

REFERENCE BOOKS:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata Mc Graw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers’, Mc Graw Hill Book Co., 1992.

4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata Mc Graw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

PTMF8711 PROJECT WORK L T P C
0 0 9 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

A project topic must be selected by the students 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 fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project.

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.

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PTGE8251 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
(Common to Manufacturing, Mechanical,Printing, Production, EEE, CSE,IT,Civil,Textile,Chemical,Industrial) 3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

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

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

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).

REFERENCE BOOKS

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)

PTMA8251 NUMERICAL METHODS L T P C

(Common to EEE, IT, Industrial, Automobile, Printing, Manufacturing) 3 0 0 3

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of algebraic and transcendental equations - Fixed point iteration method –Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and

three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

1. Grewal B.S. and Grewal J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Sankara Rao K., "Numerical methods for Scientists and Engineers', Prentice Hall of India Private Ltd., New Delhi, 3rd Edition, 2007.

REFERENCES:

1. Brian Bradie "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald C.F. and Wheatley P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Fausett L.V., "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.

PTME8071 COMPUTATIONAL FLUID DYNAMICS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

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

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 AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

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

UNIT IV FLOW FIELD ANALYSIS 9

Finite volume methods -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 – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able

- To create numerical modeling and its role in the field of fluid flow and heat transfer
- To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The finite volume Method, Pearson Education Ltd. Second Edition – 2007.
2. 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. Chung, T.J. Computational Fluid Dynamics, Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., Heat Transfer, Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, NewDelhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.
6. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.

PTME8072 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

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 AND 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 AND DRAWING DIES 10

Difference between bending 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 axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V OTHER FORMING TECHNIQUES 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.

TOTAL: 45 PERIODS

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

OUTCOMES:

- Upon completion of this course, the students can able to design jigs, fixtures and press tools.

TEXT BOOK:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. JoshiP.H “Presstools – Design and Construction”, wheels publishing, 1996.

REFERENCES:

1. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.
3. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
4. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India.
6. Design Data Hand Book, PSG College of Technology, Coimbatore.

PTME8074 ENTREPRENEURSHIP DEVELOPMENT L T P C
(Common to Manufacturing and Industrial) 3 0 0 3

OBJECTIVE:

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, 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, self Rating, Business Game, Thematic Apperception 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

OUTCOMES :

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXT BOOKS:

1. S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & 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, Ahmadabad, 1986.

PTMF8001 ELECTRONIC MATERIALS AND PROCESSING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the technology behind electronic materials and processing and their applications.

UNIT I INTRODUCTION 9

Overview of semiconductors and other basic materials - Plastics, Elastomers, and Composites -tables with material properties, terms and definitions, trade names, and material structure correlation, Mems.

UNIT II ORGANIC MATERIALS AND PROCESSES 9

Types and properties of organic materials, manufacturing technique –Vacuum Metallization, Vapour phase deposition, Thermal Imaging, Digital Lithography, Application areas.

UNIT III MEMS MATERIALS AND PROCESS 9

Mems design process- Methods, Selection of materials for process, Optimization techniques in design, Over view of additive process for –Semiconductors , Dielectric materials, Metals, and Polymer Materials, Piezo electric materials, Shape memory alloys , Micromachining techniques, packaging methods.

UNIT IV MATERIALS SYSTEMS 9

Solder technologies for electronic packaging and assembly, Electroplating and Deposited metallic coatings, Printed circuit board fabrication, Materials and Processes for Hybrid Microelectronics and Multichip modules. Adhesives under fills, and Coatings in electronics assemblies.

UNIT V THERMAL MANAGEMENT OF MATERIALS AND SYSTEMS 9

Temperature effects on circuit operation and physical construction. Laws of heat transfer mechanism and their considerations in the manufacturing process. Thermal management in packaging of electronic materials

TOTAL: 45 PERIODS

OUTCOME

- The students will be able to identify and select electronics materials in designing MEMS under different techniques by taking care of temperature effects.

TEXT BOOKS:

1. Electronic Materials and Processes Hand book By: Harper, Charles © 2004 McGraw-Hill.

2. MEMS Materials and Process Handbook by Ghodssi, Reza; Lin, Pinyen © 2011 Springer.

REFERENCE:

1. Organic Electronics, Materials, Manufacturing and applications, by Hagen Klauk © 2006 Wiley - VCH Verlag Gmbh & Co.

PTMF8002 GREEN ELECTRONICS MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:

- This course aims to provide students with knowledge on the theories, eco-design concepts, methods, and relevant hands-on experience for designing a range of sustainable green electronic products. It is expected that students will develop their ability to address relevant issues on environmental impact; product design, operating life, and the 3R concept (reduce, reuse, and recycle).

UNIT I INTRODUCTION TO GREEN ELECTRONICS 9

Environmental concerns of the modern society- Overview of electronics industry and their relevant regulations in China, European Union and other key countries- global and regional strategy and policy on green electronics industry. Restriction of Hazardous substances (RoHS) - Waste Electrical and electronic equipment (WEEE - Energy using Product (EuP) and Registration - Evaluation, Authorization and Restriction of Chemical substances (REACH).

UNIT II GREEN ELECTRONICS MATERIALS &PRODUCTS 9

Introduction to green electronic materials and products - Lead (Pb) -free solder pastes, conductive adhesives, halogen-free substrates and components. Substitution of non-recyclable thermosetting polymer based composites with recyclable materials X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products

UNIT III GREEN ELECTRONICS ASSEMBLY AND RECYCLING 9

Various processes in assembling electronics components - the life-cycle environmental impacts of the materials used in the processes - substrate interconnects . Components and process equipments used. Technology and management on e-waste recycle system construction, global collaboration, and product disassembles technology.

UNIT IV PRODUCT DESIGN AND SUSTAINABLE ECO-DESIGN 9

Stages of product development process in green design: Materials- Manufacturing - Packaging and use - End of Life and disposal - Design for recycling - Life Cycle Assessment (LCA), and Eco-design tools - Environmental management systems, and International standards - Eco-design in electronics industry

UNIT V CASE STUDIES 9

Reliability of green electronics systems , Reuse and recycle of End-of-Life(EOL) electrical and electronic equipment for effective waste management – Introduction of Green Supply Chain, and Modeling green products from Supply Chain point of view - A life-cycle assessment for eco-design of Cathode Ray Tube Recycling.

TOTAL: 45 PERIODS

OUTCOME

- The students will be able to design reliable range of sustainable green electronic products With out wastages By taking into account various environmental conditions

TEXT BOOKS:

1. Lee Goldberg, “Green Electronics/ Green Bottom Line, Newnes Publications.
2. Sammy G Shina,’ Green Electronics Design and Manufacturing Mc Graw Hill.
3. John Hu. Mohammed Ismail, “CMOS High Efficiency on – Chip Power Management, Springer Publications.

REFERENCES:

1. Green Electronic Morning: David Austen and Richard Ingleby.
2. Green Communications and Networks, by Yuhang yang and Maode Ma, Springer Publication.

PTMF8003 NANO COATING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of Nanostructured coatings.
- To understand about different coating methods and characterization of nanocoatings.
- To understand the properties change due to coatings and also the applications.

UNIT I INTRODUCTION TO NANOSTRUCTURED COATING 9

Introduction of Nanotechnology – Production of Nanoparticles - Applications of Nanoparticles – Thin Films – Significance of Thin Films - Production of Thin Films – Applications of Thin films - Coating and Surface Engineering - Coating Issues and Applications

UNIT II NANOSTRUCTURED COATINGS 9

Sol–gel Method - Chemical Reactions - Effect of Catalyst Hydrolysis - Electric Precipitation - Rotate Coating - Scattering Coating - Plasma Polymerization – Annealing - Heating Oxidation

Thermal Spraying Nano-Composites - Transitional Metal Nitride Coatings - Super Rough and Super Hard - Nanocrystalline Coatings - Nanocomposite Coatings

UNIT III CHARACTERISATION OF NANOCOATINGS 9

Thermodynamics of Nanostructured Materials - Interfaces Thermodynamics - Interface Traction - Interface Stresses - Chemical Equilibrium in Curved Interface - Influential Interface - Phase Interface - Measurement of Thermal and Electrochemical Properties - Condensed and Compressed Metals - Nano-Technological Compatibility in Coating - Improvement of Coating Quality - Abrasion, Scratch and Corrosion Resistant Coatings - Alumina as a Scratch and Abrasion Resistant – Corrosion resistant

UNIT IV PROPERTIES OF NANOSTRUCTURED COATINGS 9

Mechanical Properties - Effects of Participation of Nanoparticles in Nanocoating - Size Effect - Effective Factors on Simultaneous Deposition - Effect of Density - Effect of Current Density - Effect of pH - Pulse Current Effect - Tensile and Fatigue Strength Physical Properties - Size Effect in Sensing Characterization - Thermal Stability – Optical properties

UNIT V APPLICATIONS OF NANOCOATINGS 9

Surface Improvement for Making Fog and Vapor Resistant Layers - Self-Cleaning Glasses - Medical and Hygienic Applications - Food Packaging - Electrical and Electronic Applications - Lubricating Applications – Automobile industries – Defence applications.

TOTAL: 45 PERIODS

OUTCOMES

- Will familiarize about the science of nanocoatings
- Will demonstrate the preparation of nanocoatings
- Will develop knowledge in characteristic nanocoatings

TEXT BOOKS:

1. Aliofkhazraei M., "Nanocoatings – Size Effect in Nanostructured Films" Springer, First Edition, 2011.
2. Akhlouf S.H. and Tiginyanu I., "Nanocoatings and Ultra Thin Films: Technologies and Applications", Woodhead Publishing Ltd., 2011.

REFERENCE:

1. Cotler V.F., "Nanopowders and Nanocoatings: Production, Properties and Applications", Nova Science Pub. Inc., 2010.

PTMF8004 NON DESTRUCTIVE EVALUATION L T P C
3 0 0 3

OBJECTIVE:

- To make students to understand various Non Destructive testing methods including advanced techniques, with emphasis on basic principles, limitations and application areas.

UNIT I INTRODUCTION 9

Visual methods: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.

UNIT II LIQUID PENETRANT & MAGNETIC INSPECTION 9

Penetrant systems: Principles-Process- Liquid penetrant materials-Emulsifiers-cleaners developers-sensitivity-Advantages, Limitations and Applications. Magnetic methods: Advantages, Limitations-Methods of generating fields: magnetic particles and suspending liquids Magnetography-field sensitive probes: applications. Measurement of metal properties.

UNIT III RADIOGRAPHIC METHODS 9

Principles of radiography- sources of radiation- Ionising radiation -sources-X-rays, gama rays-Recording of radiation-Radiographic sensitivity-Fluoroscopic methods-special techniques-Radiation safety. Advantages ,Limitations and applications.

UNIT IV ULTRASONIC TESTING OF MATERIALS 9

Advantages, disadvantages, Applications, Generation of. Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques.

UNIT V ELECTRICAL AND OTHER METHODS 9

Electrical methods:Eddy current methods: potential-drop methods, applications-Other methods: Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course
The student will be able to:

- Choose the right method of testing for detection of defects on various materials.
- Will understand to operate advanced NDT instruments and equipments easily
- They will know the safety procedures of operating the NDT equipments and follow them.
- They will exploit the advantages of NDT in industrial applications for the benefit of the society.

TEXT BOOKS:

1. Halmshaw R., "Non Destructive Testing", Edward Arnold Publication, London, 1987.
2. Hull B. and John V., "Non-destructive testing", English Language Book Soc., 1989.
3. Ravi Prakash, "Non destructive Testing Techniques", New Age Science, 2009.

REFERENCES:

1. Metals Handbook, "Nondestructive Inspection and Quality Control", Vol. 17, 9th Edition, ASM International
2. Hellier C., "Handbook of Non destructive Evaluation", McGraw-Hill Professional, I edition, 2001.
3. "Non destructive Testing Handbook", Vol. 1-10, 3rd Edition, American Society for Non Destructive Testing, 2010.

PTMF8005 PRECISION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To provide and enhance the technical knowledge in precision engineering, its components and applications.

UNIT I PRECISION ENGINEERING 8

Introduction – Precision, Accuracy & Smoothness – Need – Development of overall machining precision-Classes of achievable machining Accuracy-Precision machining-High precision Machining-Ultra precision Machining-application of precision machining- Materials for tools and machine elements – carbides – ceramic, CBN & diamond-Tool and work material compatibility.

UNIT II PRECISION MACHINE ELEMENT 9

Introduction – Guide ways – Drive systems – Spindle drive – preferred numbers - Rolling elements – hydrodynamic & hydrostatic bearings –Hybrid fluid bearings- Aero static and aero dynamic bearings-Hybrid gas bearings-materials for bearings.

UNIT III ERROR CONTROL 9

Error – Sources – Static stiffness – Variation of the cutting force – total compliance – Different machining methods – Thermal effects – heat source – heat dissipation – Stabilization – decreasing thermal effects – forced vibration on accuracy – clamping & setting errors – Control – errors due to locations – principle of constant location surfaces.

UNIT IV PRECISION MANUFACTURING 9

Micro machining processes-diamond machining - micro engraving - Micro replication techniques-forming-casting-injection moulding - micro embossing - Energy assisted processes - LBM, EBM, FIB, Micro electro discharge machining-photolithography-LIGA process- Silicon micro machining-Wet and dry etching-thin film deposition.

UNIT V MEMS 10

Introduction – MEMS –characteristics- principle – Design – Application: automobile, defence, health care, Industrial, aerospace etc.,

TOTAL:45 PERIODS

OUTCOME:

Students will:

- Operate high precision machineries with ease.
- Research and explore new areas of cutting tools.

TEXT BOOKS:

1. Venkatesh V.C. and Izman S., "Precision Engineering", Tata McGraw Hill, 2007.
2. Murthy R.L., "Precision Engineering", New Age International, 2009

REFERENCE BOOKS:

1. Nakazawa H., "Principles of Precision Engineering", Oxford University Press, 1994.
2. Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.

PTMF8006 PROCESSING OF PLASTICS AND COMPOSITE MATERIALS L T P C 3 0 0 3

OBJECTIVE:

- The purpose of this subject is to equip the students with the knowledge of processes utilized in developing materials or making components using plastics and composite materials. This subject develops the competence of the students in major industrially practiced processing techniques.

UNIT I INTRODUCTION TO PLASTICS AND COMPOSITE 7

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics –Elastomers- Applications - Merits and Disadvantages - Fibres - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics.

UNIT II PROCESSING OF PLASTICS 9

Thermoplastics: Extrusion moulding- Injection Moulding - Blow Moulding –Rotational moulding- calendaring-Film blowing-thermoforming-Thermoset plastics: Compression, Transfer Moulding,Jet moulding, Laminated plastics – Casting-Machining of Plastics: Machining Parameters and their effect - Joining of Plastics - Mechanical Fasteners – Chemical bonding-Thermal bonding – Thermal welding.

UNIT III PROCESSING OF POLYMER MATRIX COMPOSITES 11

Open Mould Processes, Bag Moulding, Compression Moulding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Moulding - Application of PMC's.

UNIT IV PROCESSING OF METAL MATRIX COMPOSITES 9

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres - Liquid State Fabrication Methods: Infiltration -Squeeze Casting - Rheo Casting – Compo casting - Application of MMC's.

UNIT V PROCESSING OF CERAMIC MATRIX COMPOSITES 9

Coldpressing and sintering-hot pressing-rection bonding processes-Liquid infiltration-Lanxide process-In situ chemical reaction techniques:chemical vapour infiltration-chemical vapour deposition-Reactive consolidation-sol-gel techniques-pyrolysis-self propogating high temperature synthesis-Electropherotic deposition.-Application of CMC's

TOTAL: 45 PERIODS

OUTCOME:

- The students will be able to identify various processing methods used for different types of plastics used in our daily life.
- This subject induces the students to do project work in the area of composite materials.

TEXT BOOKS:

1. Muccio E.A. "Plastics processing technology" , ASM International, 1994.
2. Chawla K.K., "Ceramic matrix composites Springer", 2nd Edition, 2003.
3. Gowri S., Hariharan P. and Suresh Babu A, "Manufacturing Technology-I" Pearson Education, 2008

REFERENCES:

1. Belofsky K., Plastics: :Product Design and Process Engineering Hanser Publishers, 1995.
2. Kobyashi A., "Machining of Plastics", Mc-Graw Hill, 1967
3. Chawla K.K., "Composite Materials science and Engineering", 2nd Edition Springer, 1988.
4. Agarwal D. and Broutman L.J., "Analysis and Performance of Fiber Composites", Wiley, 1990.
5. Mallick P.K. and Newman S., "Composite Materials Technology", Hanser Publishers, 1991.

PTMF8007 QUALITY CONTROL AND RELIABILITY ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- Teach the essentiality of SQC, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques.
- Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I STATISTICAL QUALITY CONTROL 9

Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes -Cumulative sum and Exponentially weighted moving average control charts - Other SPC Techniques – Process - Capability Analysis - Six sigma concept.

UNIT II ACCEPTANCE SAMPLING 9

Acceptance Sampling Problem - Single sampling plans for attributes – double sampling - multiple sampling - sequential sampling - Military standards - The Dodge Roming sampling plans – Random sampling

UNIT III RELIABILITY ENGINEERING 9

Definition of reliability – Performance and reliability - Reliability requirements – System life cycle – Mean time between failures – Mean time to failure - Mortality Curve - Availability – Maintainability.

UNIT IV FAILURE DATA ANALYSIS 9

Statistical failures of components – failure distributions – Bath tub curve – Negative exponential distribution – Normal distribution - log normal distribution – Gamma distribution - Weibull distribution Life distribution measurements – Accelerated life tests - Data requirements for reliability.

UNIT V RELIABILITY PREDICTION AND MANAGEMENT 9

Failure rate estimates - Effect of environment and stress - Series and Parallel systems - RDB analysis – Standby Systems - Complex Systems - Reliability demonstration testing - Reliability growth testing - Duane curve - Risk assessment – FMEA and Fault tree analysis.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course

The student will be able to:

- Know and apply various quality tools to tackle dynamic industrial situations.
- Give a quality index to an industrial situation following an engineering approach.
- Estimate process capability and take remedial actions at the right time to have the processes under control.
- Understand reliability, various modes of failures, maintenance, replacement of machineries and equipments at the right time and be instrumental in enriching the industrial culture with quality policy leading to higher productivity.

TEXT BOOKS:

1. Khanna O.P., “Statistical Quality Control”, Dhanpat Rai Publications (P) Ltd., 2001.
2. Lewis E.E., “Introduction to Reliability Engineering”, John Wiley and Sons, 1987.

REFERENCES:

1. Zairi M., “Total Quality Management for Engineers”, Woodhead Publishing Limited 1991.
2. Noori H. and Russell, “Production and Operations Management - Total Quality and Responsiveness”, McGraw-Hill Inc, 1995.
3. Montgomery D.C., “Introduction to Statistical Quality Control”, 2nd Edition, John Wiley and Sons, 1991.
4. Klaasssen H.B. and Peppen J.C.L, “System reliability concepts and applications”, Edward Arnold, 1989.

PTMF8008 SENSORS AND CONTROL SYSTEMS IN MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:

- To introduce concepts of sensors and control systems and their applications in Manufacturing.

UNIT I INTRODUCTION 9

Sensor Fundamental , Classification and Types of Sensors, Desirable Sensor Attributes, Sensor Performance and Power dissipation -a trade off, Self Checking and Self Compensating Sensors- Sensor for Work Pieces and Product Monitoring.

UNIT II SENSOR IN PRECISION MANUFACTURING 9

Identification of Manufactured Components, Digital Encoders, Opto Electronic Color Sensors- Principles, Properties, Features and Control Applications in Robotics.

UNIT III SENSORS AND CONTROL IN CIM AND FMS 9

Design of CIM, Decision Support System For CIM , Analysis and Design of CIM , and Development of CIM Strategy with Sensor and Control . FMS- Robot Control with Vision Sensors, Multi Sensor Controlled Robots, Measurement of Robot Density, Robot Programming,

UNIT IV NETWORKING OF SENSORS AND CONTROL SYSTEM IN MANUFACTURING 9

Sensor Network Architecture , Sensor Tracking, Sensors to Detect Machinery Faults, Networks in Manufacturing, Computer Communications- Interface of Sensors With Single Board Computer for PLC, and Numerical Control. Networking with Electro Optic Link using Fiber Sensors.

UNIT V RECENT TRENDS IN SENSOR AND CONTROL SYSTEM 9

Fiber Optics in Sensor and Control System.- Fibre Optics Parameters, Configurations, Photo Electric Sensor for Long Distance, Sensor Alignment Techniques, Sensors for Biomedical Technology.

TOTAL: 45 PERIODS

OUTCOME

- The students will be able to design and control various manufacturing process using suitable sensors and control techniques.

TEXT BOOK:

1. Sabrie Soloman, Sensors and Control systems in manufacturing, Mc Graw hill publications, second edition 2010.

REFERENCE:

1. H.K Tonshoff, &I.Inasaki, Sensor Applications, vol 1 sensors in manufacturing, wiley- vch publications 2001.

PTMF8009 SYSTEM SIMULATION L T P C
3 0 0 3

OBJECTIVES:

- To understand the importance and advantages of applying simulation techniques for solving various problems on discrete event systems.
- To teach various random number generation techniques, its use in simulation, tests and validity of random numbers etc. Development of simulation models, verification, validation and analysis. Introduction to various simulation languages and comparison

UNIT I INTRODUCTION 6

History of simulation - Concept – simulation as a decision making tool-Advantages of simulation, Disadvantages, Applications - Monte Carlo simulation-Simulators.

UNIT II RANDOM NUMBERS/VARIATES 9

Generation of Random numbers-Applications - Pseudo random numbers – methods of generating random variates – random variates for uniform, normal, binominal, Poisson, exponential distributions.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 14

Problem formulation – data collection and reduction – logic developments – initial conditions – run length, tabular method of simulation – development of models using higher level languages for systems like queuing, production, inventory and maintenance – output analysis and interpretation, validation.

UNIT IV DISCRETE SYSTEM SIMULATION LANGUAGES 6

Need for simulation language – Comparison of simulation languages: SIMCRIPT, GASP, SIMULA, GPSS, PROMODEL, EXTEND, ARENA etc…

UNIT V QUEUING POLICIES, ALGORITHMS AND CASE STUDIES 10

Introduction to basic Single-pass heuristics, meta-heuristics and applications-Application of Genetic algorithms and Ant colony based algorithms in Discrete event simulation models with simple examples.

Development of simulation models using the simulation language studies for systems for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.

TOTAL: 45 PERIODS

OUTCOME:

- The student will be able to understand industrial scenarios, involve in intelligent questioning sessions with experts to get clear insight about the problem and build an appropriate simulation model
- The students can understand the type of model to be built suiting to the industrial situation and choose right measures of performances for evaluation and analysis.
- They can justify their findings with statistical analysis and successfully compromise the management in implementing their proposed ideas and produce results.
- Students can easily understand simulation models developed in other simulation software and involve in expert suggestions to improvise the same.
- They can teach simulation situations through their own models and show the effects of altering them.

TEXT BOOK:

1. Banks J and Carson J.S., Nelson B.L, “Discrete event system simulation”, 4th Edition, Pearson, 2005.

REFERENCE BOOKS:

1 Schriber T.J., “Simulation using GPSS”, John Wiley, 2002.
2. Law A.M. and Kelton W.D., “Simulation Modeling and Analysis”, McGraw Hill, 2003.

WEB REFERENCE BOOKS:

1. http:www.bcnn.net.

PTMF8010 THEORY OF METAL CUTTING L T P C
3 0 0 3

OBJECTIVES:

- To learn tool nomenclature, mechanical of metal cutting and forces in metal cutting.
- To know the thermal aspects in machining, tool materials, tool life and wear mechanisms

UNIT I TOOL NOMENCLATURE 8

Single point tool-significance of the various angles provided and nose radius-American, German CIRP and orthogonal system of tool nomenclature, nomenclature of drills, milling cutters and broaches-grinding wheels, Need for chip breakers.

UNIT II MECHANICS OF METAL CUTTING 10

Mechanisms of formation of chips-types of chips and the conditions conducive for the formation of each type built- up edge, its effects orthogonal Vs oblique cutting-Merchant's circle diagram-Force and Velocity relationship, shear plane angle, Energy considerations in matching-Ernst Mechant's theory of shear angle relationship-original assumption and modifications made.

UNIT III FORCES IN MACHINING 9

Forces in turning, drilling, milling and grinding, conventional Vs climb milling-mean and maximum cross sectional areas of chip in milling-specific cutting pressure-specific horse power-requirements of tool dynamometers-construction and principle of operation of tool dynamometers for turning, drilling and milling

UNIT IV THERMAL ASPECTS IN MACHINING 9

Sources of heat generation in machining-temperature measurement techniques in machining, Functions of cutting fluid-characteristics of cutting fluid-types, modes of applications, additives-application of cutting fluids- dry machining, Minimum Quantity Lubrication (MQL) machining.

UNIT V TOOL MATERIALS, TOOL WEAR AND TOOL LIFE 9

Requirements of tool materials-advances in tool materials-HSS, coated HSS, carbides and coated carbides, ceramic, cold pressed, hot pressed, ceramic composites, CBN, PCD, properties, advantages and limitations-ISO-specifications for inserts and tool holders, tool wear, type mechanisms, tool life, machinability, economics of machining, chatter in machining.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- The student will be able to understand various tool nomenclatures
- Use this knowledge to calculate forces in machining
- Use this knowledge for the selection of tools for various machining operations

TEXT BOOK:

1. Juneja B.L and Sekhon G.S., “Fundamentals of Metal cutting and Machine Tools”,New Age International (P) Ltd., 2008.

REFERENCES:

1. Shaw M.C., “Metal cutting principles”, Oxford, Clarendon Press, 2004. ISBN13: 9780195142068
2. Bhattacharya A. “Metal Cutting Theory and Practice”, New Central Book Agency (p) Ltd., Calcutta, 1984.

3. Venkataesh V.C and Chandrasekaran. H, “Experimental Techniques in Metal Cutting”, Prentice Hall of India, 1982.
4. Xing Sheng Li & Low.I.M., Editors, “Advanced ceramic tools for machining Applications”,I TRANSTECH PUBLICATIONS, 1994.
5. Kuppuswamy. G., “Principles of Metal Cutting”, Universities Press, 1996.

PTMF8011 VALUE ENGINEERING AND REENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand and analyze the theory and methodology of Value Engineering with the Guidelines, Performa and Checklist for a systematic, step by step application of the technique to the current industrial problems.
- To provide the knowledge about Reengineering Principles, the various models and implementation method, which are adopted in the industry.

UNIT I FUNDAMENTALS OF VALUE ENGINEERING 11

Value Types – How to add value job plan – Technique employed - Selection of project and team members – Value Engineering Job Plan – Benefits - Audit

UNIT II VALUE ENGINEERING AND JOB PLAN 10

General and information phase – Function Classification, Fast diagram– Meaningful costs – Cost analysis – idea listing and comparison – Feasibility ranking – Investigator phase, study summary – guidelines for writing value engineering proposal – Financial aspects – List cycle cost analysis – Oral presentation – Audit – Case studies and Discussion.

UNIT III REENGINEERING PRINCIPLES 8

The 6R’s of organizational transformation and reengineering – process reengineering – preparing the workforce – Principles of Transformation and Reengineering - Methodology – Organisational Transformation Guidelines

UNIT IV REENGINEERING PROCESS IMPROVEMENT MODELS 8

Transformation Models – Performance Improvement Model - PMI leadership expectation – Production and service improvement model – Moen and Nolan Strategy Model – Quality Models – Personal and Process improvement.

UNIT V IMPLEMENTATION OF REENGINEERING 8

Process analysis techniques – Work flow analysis – Value analysis approach – Nominal group technique – Fish bone diagram – Pareto analysis – team building – Force field analysis – Implementation.

TOTAL: 45 PERIODS

OUTCOME:

- The student will be able to practice the principles of value manufacturing
- This domain knowledge will help them to systematically doing value analysis
- The students will understand Systematic starting over and reinventing the way a firm, or a business process

TEXT BOOKS:

1. Iyer S.S., “Value Engineering”, New Age Information, 1996.
2. Dr. Edosomwan J.A., “Organization Transformation and Process reengineering”, British Library Cataloguing in Publication data, 1996.

REFERENCE BOOK:

1. Younker D.L., “Value Engineering”, Marcel Dekker, Inc., 2003.

PTMF8071 ADDITIVE MANUFACTURING TECHNOLOGY L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.

UNIT I INTRODUCTION 10

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

UNIT II CAD & REVERSE ENGINEERING 10

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 10

Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS 10

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

UNIT V MEDICAL AND BIO-ADDITIVE MANUFACTURING 5

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies

TOTAL: 45 PERIODS

OUTCOME

- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

TEXT BOOKS:

1. Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.
2. Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003.

REFERENCES:

1. Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
3. Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.

PTMF8072 ELECTRONICS MANUFACTURING TECHNOLOGY L T P C
(Common to Manufacturing and Industrial) 3 0 0 3

OBJECTIVES:

- To understand wafer preparation and PCB fabrication, the types of Mounting Technologies and components for electronics assembly & SMT process in detail.
- To know various Defects, Inspection Equipments SMT assembly process and repair, rework and quality aspects of Electronics assemblies.

UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING 8

History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed circuit boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection.

UNIT II COMPONENTS AND PACKAGING 9

Introduction to packaging, types-Through hole technology(THT) and Surface mount technology(SMT), Through hole components – axial, radial, multi leaded, odd form. Surface-mount components- active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.

UNIT III SURFACE MOUNT TECHNOLOGY PROCESS 12

Introduction to the SMT Process, SMT equipment and material handling systems, handling of components and assemblies - moisture sensitivity and ESD, safety and precautions needed, IPC and other standards, stencil printing process - solder paste material, storage and handling, stencils and squeegees, process parameters, quality control. Component placement- equipment type, flexibility, accuracy of placement, throughput, packaging of components for automated assembly, Cp and Cpk and process control. soldering- reflow process, process parameters, profile generation and control, solder joint metallurgy, adhesive, underfill and encapsulation process - applications, materials, storage and handling, process and parameters.

UNIT IV INSPECTION AND TESTING 9

Inspection techniques, equipment and principle - AOI, X-ray. Defects and Corrective action - stencil printing process, component placement process, reflow soldering process, underfill and encapsulation process, electrical testing of PCB assemblies- In circuit test, functional testing, fixtures and jigs.

UNIT V REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES 7

Repair tools, methods, rework criteria and process, thermo-mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, reworkability, testing, reliability, and environment.

TOTAL: 45 PERIODS

OUTCOMES:

- Perform fabrication of PCBs and use of mounting technology for electronic assemblies.
- Perform quality inspection on the PCBs

TEXT BOOKS:

1. Prasad R., “Surface Mount Technology –Principles and practice”, second Edition, Chapman and Hall, 1997, New York, ISBN 0-41-12921-3.

2. Tummala R.R., “Fundamentals of microsystem packaging”, Mc -Graw Hill, 2001, ISBN 00-71-37169-9.

REFERENCE BOOKS:

1. Puligandla Viswanadham and Pratap Singh, “Failure Modes and Mechanisms in Electronic Packages”, Chapman and Hall, New York, 1997, N.Y. ISBN 0-412-105591-8.
2. Totta P., Puttlitz K. and Stalter K., “Area Array Interconnection Handbook”, Kluwer Academic Publishers, Norwell, MA, USA, 2001. ISBN 0-7923-7919-5.
3. Lee N.C., “Reflow Soldering Process and Trouble Shooting SMT,BGA,CSP and Flip Chip Technologies”, 2001, Elsevier Science,
4. Zarrow P. and Kopp D. “Surface Mount Technology Terms and Concepts”, 1997, Elsevier Science and Technology,.ISBN 0750698756.
5. Harper C.A., “Electronic Packaging and Interconnection Handbook” Second Edition, McGraw Hill Inc., New York, N.Y., 1997, ISBN 0-07-026694-8.
6. Martin B. and Jawitz W., “Printed Circuit board materials handbook”, McGraw-Hill Professional, 1997.
7. Lau J.H., “Ball Grid Array Technology, McGraw-Hill Professional, 1997.
8. www.ipc.org.

PTMF8073 FLEXIBLE MANUFACTURING SYSTEMS L T P C
(Common to Manufacturing and Industrial) 3 0 0 3

OBJECTIVES:

- To understand the Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

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

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURINGSYSTEMS 9

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE 9

Application of simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS 9

Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification.

UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE 9

FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to perform Planning, Scheduling and control of Flexible Manufacturing systems
- Perform simulation on software's use of group technology to product classification

TEXT BOOK:

1. Jha.N.K., "Handbook of flexible manufacturing systems", Academic Press Inc., 1991.

REFERENCE BOOKS:

1. Radhakrishnan P. and Subramanyan S., "CAD/CAM/CIM", Wiley Eastern Ltd., New Age International Ltd., 1994.
2. Raouf A. and Daya B.M., "Flexible manufacturing systems: recent development", Elsevier Science, 1995.
3. Groover M.P., "Automation, production systems and computer integrated manufacturing", Prentice Hall of India Pvt., New Delhi, 1996.
4. Kalpakjian S., "Manufacturing Engineering and Technology", Addison-Wesley Publishsing Co., 1995.
5. Ohno T., "Toyota production system: beyond large-scale production", Productivity Press (India) Pvt. Ltd., 1992.

PTMF8074 MEMS AND MICRO SYSTEM FABRICATIONS L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVES:

- To understand the mechanics, scaling and design of micro system
- To learn various micro fabrication processes
- To impart knowledge on microsystems packaging and metrology of micro machined components

UNIT I INTRODUCTION 9

Overview of MEMS and Microsystems: MEMS and Microsystems, Evolution of Micro fabrication, Microsystems and Microelectronics, Microsystems and miniaturization-Materials for MEMS and Microsystems: substrates and wafers, active substrate materials, Silicon, Galium Arsenide, Piezoelectric Crystals, Polymers, Packaging materials-Working principles of Microsystems: micro sensors, micro actuation, MEMS with micro actuators, Micro accelerometers, micro fluidics-Applications of Microsystems in various industries

UNIT II MECHANICS, SCALING AND DESIGN 9

Engineering Mechanics for Microsystems design: Introduction, Static bending of Thin Plates, Mechanical Vibration, Thermomechanics, Thermofluid Engineering and micro system design, Laminar fluid flow, Incompressible fluid Flow, Heat conduction in solids-Scaling Laws in Miniaturization, Introduction to scaling, Scaling in (Electrostatic forces electromagnetic forces, Electricity, fluid mechanics, heat transfer)-Microsystems Design: Design Consideration, Process design, Mechanical Design, Design of Micro fluidic Network systems

UNIT III MICRO SYSTEM FABRICATION PROCESSES 12

Introduction- Photolithography- Ion implantation- Chemical Vapor deposition-Physical Vapor deposition - clean room- Bulk micromachining :etching, isotropic and anisotropic etching, wet and dry etching- Surface micro machining :process, mechanical problems associated with surface micro machining- LIGA process :general description, materials for substrates and photo resists-SLIGA process-Abrasive jet micro machining-Laser beam micro machining-Micro Electrical Discharge Micro Machining –Ultrasonic Micro Machining- Electro chemical spark micro machining- Electron beam micro machining-Focused Ion Beam machining

UNIT IV TOOL BASED MICROMACHINING 7

Theory of tool based micromachining-Chip formation-size effect in micromachining-micro turning, micro milling, and micro drilling- Micromachining tool design-Precision Grinding-Partial ductile mode grinding-Ultra precision grinding- Binderless wheel Free form optics.

UNIT V MICROSYSTEMS PACKAGING AND METROLOGY OF MICRO MACHINED COMPONENTS 8

Introduction - Microsystems Packaging-Interfaces in Microsystems Packaging-Essential Packaging Technologies-Three dimensional Packaging- Assembly of Microsystems- Signal Mapping and Transduction-Metrology of Micromachined components: SEM, optical microscopy, Scanning white light interferometry, Confocal Laser scanning microscopy, SPM, Molecular measuring machine, Micro coordinate measuring machine

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- The student will be able to understand various MEMS techniques
- Use this knowledge to design MEMS
- Use this knowledge to measure MEMS components

TEXT BOOKS:

1. Hsu T.R., “MEMS & Microsystems Design and Manufacture”, Tata McGraw Hill, 2002, ISBN: 9780070487093.
2. Jain V.K., “Introduction to Micromachining” Narosa Publishing House, 2010.

REFERENCE BOOKS:

1. Jackson M.J., “Microfabrication and Nanomanufacturing” Taylor and Francis 2006.
2. McGeough J.A., “Micromachining of Engineering Materials”, CRC Press, 2001, ISBN: 0824706447
3. Hak M.G., “MEMS Handbook”, CRC Press, 2006.
4. Madou M.F. “Fundamentals of Micro fabrication”, CRC Press, 2002, 2nd Edition.

PTMF8075 NANOTECHNOLOGY L T P C

(Common to Manufacturing and Printing) 3 0 0 3

OBJECTIVES:

At the end of this course the students are expected to understand the general issues relating to nanotechnology and nanofabrication.

- Methods for production of Nanoparticles
- Characteristic techniques of Nanomaterials

UNIT I INTRODUCTION TO NANOMATERIALS 9

Amorphous, crystalline, microcrystalline, quasi-crystalline and nano-crystalline materials. Classification of Nanomaterials – Size Effects – Surface to volume ratio, Strain confinement, Quantum Effects – Properties – Mechanical, Thermal, Electrical, Optical, Magnetic, Acoustic.

UNIT II SYNTHESIS OF NANOMATERIALS 12

Methods of production of Nanoparticles – Top–Down processes, Bottom-Up Processes - Sol-gel synthesis, Inert gas condensation, Sonochemical processing, Molecular self assembly, High energy Ball milling, Plasma synthesis, Electro deposition, Chemical vapour deposition, Physical vapour deposition, and other techniques. Synthesis of Carbon Nanotubes – Solid carbon source based production techniques, Gaseous carbon source based production techniques - Issues in fabrication of nanomaterials Nano wires.

UNIT III CHARACTERISATION OF NANOMATERIALS 9

Scanning Probe Microscopy (SPM) – Scanning tunneling microscope, Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning force microscopy, Electrostatic force microscopy , Dynamic force microscopy, Magnetic force microscopy, Scanning thermal microscopy, Peizo force microscopy, scanning capacitance microscopy, Nano indentation - Issues in characterization of nanomaterials.

UNIT IV APPLICATIONS OF NANOMATERIALS 9

Applications in Mechanical, Electronics engineering industries – Use of nanomaterials in automobiles, aerospace, defense and medical applications – Metallic, polymeric, organic and ceramic nanomaterials.

UNIT V NANO FABRICATION AND MACHINING 9

LIGA, Ion beam etching, Molecular manufacturing techniques – Nano machining techniques – Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum materials.

TOTAL: 45 PERIODS

OUTCOME:

At the end of this course

- The student will be able to produce nanomaterials using various techniques
- Use this knowledge to characterize nanomaterials
- Use this knowledge to fabricate nano-scaled products

TEXT BOOKS:

1. Bhushan B., “Handbook of Nanotechnology”, Springer, Germany, 2004.
2. Ashby M.F., Ferreira P.J. and Schodek D.L., “Nanomaterials, Nanotechnologies and Design”, Elsevier Ltd., 2009.

REFERENCES:

1. Ratner M. and Ratner D., “Nano Technology”, Pearson Education, New Delhi, 2003.
2. Timp G., “Nanotechnology”, Springer, India, 2005.
3. Busnaina A., “Nanomanufacturing Handbook”, CRC Press, London, 2006.
4. Lakhtakia A., “Nanometer Structures – Theory, Modeling and Simulation”, PHI Learning Private Limited, NewDelhi, 2009.

PTMF8076 PRODUCT DESIGN AND DEVELOPMENT L T P C
(Common to Manufacturing and Mechanical) 3 0 0 3

OBJECTIVE:

- To teach the students basic concepts of Product Design and Process Development. Expose the students to the importance, various stages, concepts, management and prototyping of Product Design and Process Development.

UNIT I INTRODUCTION 9

Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement.

UNIT II CONCEPT GENERATION, SELECTION AND TESTING 9

Plan and establish product specifications. Task - Structured approaches - clarification - search-externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance – manufacturability.

UNIT III PRODUCT ARCHITECTURE 9

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV INDUSTRIAL DESIGN 9

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

1. Ulrich K.T. and Eppinger S.D., “Product Design and Development” McGraw –Hill International Editions,1999.

REFERENCES:

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Rosenthal S., “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Pugh S., “Total Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991, ISBN 0-202-41639-5.

PTMF8077 TOTAL PRODUCTIVE MAINTENANCE L T P C
(Common to Manufacturing and Printing) 3 0 0 3

OBJECTIVE:

- To teach the students basic concepts of Total Productive Maintenance. Expose the students to the objectives, maintenance models, group activities, logistics, condition monitoring and implementation of Total Productive Maintenance.

UNIT I MAINTENANCE CONCEPTS 9

Introduction - Objectives and functions – Productivity, Quality, Reliability and Maintainability (PQRM) - Terotechnology – Reliability Centered Maintenance - Predictive Maintenance - Condition Based Maintenance – maintainability prediction – availability and system effectiveness- maintenance costs – maintenance organization.

UNIT II MAINTENANCE MODELS 9

Minimal repair – As Good As New policy – maintenance types – balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values – PM schedules: functional characteristics – replacement models.

UNIT III TOTAL PRODUCTIVE MAINTENANCE 9

Zero breakdowns – Zero Defects and TPM – maximizing equipment effectiveness – Autonomous maintenance program – five pillars of TPM – TPM small group activities – TPM organization – Management Decision – Educational campaign – Creation of Organizations – Establishment of basic policies and goals – Formation of master plan - TPM implementation.

UNIT IV MAINTENANCE LOGISTICS 9

Human factors in maintenance – maintenance manuals – maintenance staffing methods – queuing applications – simulation – spare parts management – maintenance planning and scheduling.

UNIT V ONLINE MONITORING 9

Condition monitoring - Infrared Thermography, Oil Analysis, acoustic emissions testing, Motor Current Analysis, Vibration Measurement and Analysis, Wear Debris Monitoring, Visual checks - corrosion control - Maintenance Management Information System - Expert system applications.

TOTAL: 45 PERIODS

OUTCOMES

- Implementation the concept of total productive maintenance to the industries
- Effectively use the total productive maintenance for online monitoring of processes

TEXT BOOKS :

1. Nakajima S., “Introduction to TPM”, Productivity Press, Chennai, 1992.
2. Srivastava S.K., “Maintenance Engineering (Pri.Practices & Management)”, S. Chand Group, 2011.

REFERENCES :

1. Wireman T., “Total Productive Maintenance”, Industrial Press Inc., New york, 2004
2. Goto F., “Equipment planning for TPM Maintenance Prevention Design”, Productivity Press, 1992.
3. Shirose K., “Total Productive Maintenance for Workshop Leaders”, Productivity Press, 1992.
4. Shirose K., “TPM for Operators”, Productivity Press, 1996.
5. Suzuki T., “New Directions for TPM”, Productivity Press, 1993.
6. Kelly A., “Maintenance planning and control”, Butterworths, London, 1991.

PTMG8651 TOTAL QUALITY MANAGEMENT L T P C
(Common to Manufacturing, Mechanical, Printing, Production, CSE, Industrial, ECE, IT,EEE, Industrial, Leather, Automobile) 3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA 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 – Performance measures - BPR.

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 –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint , 2006.

REFERENCE BOOKS:

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.

PTPR8071 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT **L T P C 3 0 0 3**

(Common to Production, Manufacturing and Leather)

OBJECTIVE:

- To introduce the concepts of economics as applied to Engineering and Management of Finance in business.

UNIT I FINANCIAL ACCOUNTING 12

Accounting principles – preparation and interpretation of profit and loss statement – balance sheet – Fixed assets – current assets – depreciation – depreciation methods.

UNIT II PROFIT VOLUME ANALYSIS 10

Cost volume profit relationship – relevant costs in decision making – profit management analysis – break even analysis – margin of safety – angle of incidence and multi product break even analysis Effect of changes in volume, selling price, fixed cost and variable cost.

UNIT III WORKING CAPITAL MANAGEMENT 8

Current assests and liability decisions – Estimation of working capital requirements – Management of accounts receivable – Inventory – Cash – Inventory valuation methods.

UNIT IV CAPITAL BUDGETING 7

Significance of capital budgeting – payback period – present value method – Accounting rate of return method.

UNIT V ENGINEERING ECONOMICS 8

Economics – Engineering economics – Demand analysis – Laws of demand – Production and cost – Pricing methods – Cost volume profit analysis.

TOTAL: 45 PERIODS

OUTCOME

- The student will be in a position to plan for finance and budget and will be able to manage finance.

TEXT BOOK:

1. R.Kesavan, C. Elanchezian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005.

REFERENCES:

1. C.James, Vanhorn, Fundamentals of Financial Management PHI 1996.
2. Charles T.Homgren, Cost Accounting, PHI 1985.
3. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

PTPR8072 SURFACE ENGINEERING **L T P C**

(Common to Manufacturing and Production) **3 0 0 3**

OBJECTIVE:

- To expose the student on the various treatment and procedures available.

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING 8

Need and relevance of surface engineering – pre-treatment of coating. General cleaning process for ferrous and non ferrous metals and alloys – selection processes – alkaline cleaning – emulsion cleaning – ultrasonic cleaning – acid and pickling salt bath descaling –

abrasive bath cleaning – polishing and bulling shot peening – classification of surface engineering processes.

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS 10

Thermal spraying – Flame, arc, plasma and HVOF processes – PLV process – Design for thermally sprayed coatings – coating production – Spray consumables – principles of electroplating – Technology and control – electroplating systems – properties and Faraday's Law – factors affecting throwing power – Applications of electrodeposites – non aqueous and electroless deposition.

UNIT III HOT DIP COATING AND DIFFUSION COATINGS 10

Principles – surface preparation – batch coating and continuous coating process – coating properties and applications. Principles of cementation – cladding – Diffusion coating of C, N, Al, Si, Cr and B – structure, properties and application of diffusion coatings – chemical vapour deposition – physical vapour deposition.

UNIT IV NON-METALLIC COATING OXIDE AND COVERSION COATINGS 9

Plating coating – Lacquers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, inc, cadmium copper and silver – phosphating primers.

UNIT V QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS 8

The quality plan – design – testing and Inspection of thickness adhesion, corrosion, resistance and porosity measurement – selection of coatings – industrial applications of engineering coatings. Basic Mechanisms of wear – abrasive, adhesive wear, contact fatigue – Fretting corrosion – Testing wear resistance – practical diagnosis of wear.

TOTAL: 45 PERIODS

OUTCOMES:

- Explain the important of surface engineering to industries
- Use of thermal spray for coating
- Explain the process and mechanism of different diffusion coating process
- Explain the methods of non metallic coating
- Explain the testing procedure for quality assurance.

TEXT BOOK:

1. Stan Grainger engineering coatings – design and application Jaico publishing House, 1994.

REFERENCES:

1. N.V. Parthasarathy, Electroplating Handbooks, Prentice Hall, 1992.
2. Metals Hand Book vol.2 8th Edition, American society of Metals, 1994
3. D.R.Gabe, Principles of Metal surface treatment and protection, Pergamon, 1990
4. Niku-Lavi, Advances in surface treatments, Pergamon, 1990

PTPR 8551 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
(Common to Manufacturing and Production) 3 0 0 3

OBJECTIVES:

- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the principle of automobile engineering.

UNIT I ENGINE 9

Working principle of two strokes, four stroke and wankel engines – wet and dry liners – Piston and Piston rings – types – classification. Production of – Cylinder block, Cylinder head, liners, oil pan, piston and piston rings and testing.

UNIT II ENGINE PARTS 8

Working principle of crank shaft – Cam shaft – valve operating mechanisms – carburetors - spark plug Production of – Connecting rod – Crankshaft - push rod and rocker arm – valves – tappets – carburetors and spark plugs

UNIT III FUEL AND TRANSMISSION SYSTEM 10

Working principle of – Fuel pumps – fuel injection pumps of diesel engines – multi point fuel injection system – Gear Box – clutch system – differential mechanism – steering system – braking system.Production of – Friction lining materials for clutch and brakes – propeller shaft – gear box housing – steering column – Energy absorbing steering column.

UNIT IV CHASSIS AND SUSPENSION SYSTEM 8

Working principle of – Suspension system – leaf spring and shock absorbers – wheel housing – design concepts of chassis (aerodynamics and cross worthiness) Production of – Brake shoes – leaf spring – wheel disc, wheel rim –usage of non metallic materials for chassis components.

UNIT V RECENT ADVANCES 10

Application of sensors and actuators – Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners – thermal barrier coating of Engine head and valves – Selection of materials for Auto components.

TOTAL: 45 PERIODS

OUTCOME

- For a given automotive components the students will be able to select the proper sequence of manufacturing process and produce them.

TEXT BOOKS:

1. Heldt.P.M, High speed combustion engines, Oxford publishing Co., New York, 1990.

REFERENCES:

1. Kirpal Singh, Automobile Engineering ., Vol.I & II, Standard Publishers, New Delhi, 1997.
2. Newton and steels, the motor vehicle, ELBS, 1990
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Fourth Edition – Pearson Education publications – 2003.
4. Gupta K.M. Automobile Engineering Vol.I & II, Umesh Publishers, 2000.

PTGE8071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOK:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE8072 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.