

UNIVERSITY CHENNAI: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

CURRICULUM – R 2009

B.E. PRODUCTION ENGINEERING (PART TIME)

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA 9111	Applied Mathematics	3	0	0	3
2.	PTPH 9111	Applied Physics	3	0	0	3
3.	PTCY 9111	Applied Chemistry	3	0	0	3
4.	PTGE 9112	Fundamentals of Computing	3	0	0	3
5.	PTEI 9161	Electrical Engineering	3	0	0	3
TOTAL			18	1	0	16

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA 9262	Numerical Methods	3	1	0	4
2.	PTGE 9151	Engineering Mechanics	3	1	0	4
3.	PTPR 9211	Engineering Metallurgy	3	0	0	3
4.	PTPR 9253	Foundry and Welding Technology	3	0	0	3
PRACTICAL						
5.	PTPR 9256	Metallurgy Laboratory	0	0	3	2
TOTAL			12	2	0	16

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR 9251	Theory of Machines	3	1	0	4
2.	PTPR 9304	Quantitative Techniques in Management	3	1	0	4
3.	PTPR 9252	Fluid Power Drives and Control	3	0	0	3
4.	PTAU 9202	Solid Mechanics	3	1	0	4
PRACTICAL						
5.	PTPR 9257	Fluid Power Laboratory	0	0	3	2
TOTAL			12	3	3	17

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR 9303	Machine Design	3	1	0	4
2.	PTPR 9401	Manufacturing Processes Planning and Cost Estimation	3	1	0	4
3.	PTPR 9255	Metal forming Processes	3	0	0	3
4.	PTPR 9302	Metrology and Computer Aided Inspection	3	0	0	3
PRACTICAL						
5.	PTPR 9357	Metrology and Inspection Laboratory	0	0	3	2
TOTAL			12	2	3	16

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR 9254	Advanced Machining Processes	3	0	0	3
2.	PTPR 9402	Engineering Management	3	0	0	3
3.	PTPR 9353	Design of Jigs, Fixture, Press Tools and Drawing	3	1	0	4
4.	PTPR 9301	Engineering Statistics and Quality Control	3	1	0	4
PRACTICAL						
5.	PTPR 9355	CNC Laboratory	0	0	3	2
TOTAL			12	2	3	16

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR 9354	Automated production and computer integrated Manufacturing	3	0	0	3
2.	PTPR 9305	Automotive Components And Manufacturing	3	0	0	3
3.	PTPR 9351	Finite Element Analysis in Manufacturing Engineering	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICAL						
5.	PT9306	Computer Aided Design Laboratory	0	0	3	2
TOTAL			12	0	3	14

SEMESTER VII

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR 9352	Computer Aided Product Design	3	0	0	3
2.	PTPR 9404	Industrial Robotics	3	0	0	3
3.		Elective II	3	0	0	3
4.		Elective III	3	0	0	3
PRACTICAL						
5.	PTPR 9451	Project Work	0	0	12	6
TOTAL			12	0	12	14

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 109

ELECTIVES FOR B.E.PRODUCTION ENGINEERING – PART TIME

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR 9021	Precision Engineering	3	0	0	3
2	PTPR 9023	Instrumentation and Control	3	0	0	3
3	PTPR 9024	Surface Engineering	3	0	0	3
4	PTPR 9025	Design of Machine Tool Structure	3	0	0	3
5	PTPR 9030	Purchasing and Material Management	3	0	0	3
6	PTPR 9031	Non Destructive Testing Methods	3	0	0	3
7	PTPR 9026	Production Management	3	0	0	3
8	PTPR 9029	Engineering Economics and Financial Management	3	0	0	3
9	PTPR 9037	Advances in Operation Research	3	0	0	3
10	PTGE 9022	Total Quality Management	3	0	0	3
11	PTPR 9022	Fuzzy Logic and ANN	3	0	0	3
12	PTPR 9034	Machine Tool Control and Condition Monitoring	3	0	0	3
13	PTPR 9038	Modern Manufacturing Processes	3	0	0	3
14	PTGE 9023	Fundamentals of Nanoscience	3	0	0	3
15	PTPR 9028	Processing of Polymer and Composites	3	0	0	3
16	PTPR 9403	Mechatronics Systems	3	0	0	3
17	PTGE 9021	Professional Ethics in Engineering	3	0	0	3
18	PTGE 9261	Environmental Science and Engineering	3	0	0	3

UNIT I MATRICES**9**

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

UNIT II FUNCTIONS OF SEVERAL VARIABLES**9**

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

UNIT III ANALYTIC FUNCTION**9**

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

UNIT IV COMPLEX INTEGRATION**9**

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

UNIT V LAPLACE TRANSFORMS**9**

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

TOTAL: L+T= 60 PERIODS**TEXT BOOKS**

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

REFERENCES

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

UNIT I ULTRASONICS**9**

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

UNIT II LASERS**9**

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einstein's A and B coefficients - derivation. Types of lasers – He-Ne, CO₂, Nd-YAG, Semiconductor lasers - homojunction and heterojunction (Qualitative)- Industrial Applications-Lasers in welding, heat treatment and cutting- Medical applications - Holography (construction and reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS**9**

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

UNIT IV QUANTUM PHYSICS**9**

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

UNIT V CRYSTAL PHYSICS**9**

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

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

REFERENCES:

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

PTCY9111**APPLIED CHEMISTRY****L T P C
3 0 0 3****UNIT I WATER TREATMENT AND POLLUTION CONTROL 9**

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

UNIT II FUELS 9

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

UNIT III THERMODYNAMICS AND SURFACE CHEMISTRY 9

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

UNIT IV ELECTROCHEMISTRY - CORROSION AND CATALYSIS 9

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

UNIT V POLYMERS-COMPOSITES AND NANOCHEMISTRY 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES

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

PTGE9112**FUNDAMENTALS OF COMPUTING**
(Common to all branches of BE / B.Tech)**L T P C**
3 0 0 3**UNIT I****9**

Computer systems – Exploring computers – Inside the system – processing data – CPUs – Types of storage devices - Operating systems basics – networking basics.

UNIT II**9**

The internet and the WWW – Internet services – connecting to the internet - Working with applications software – productivity software – graphics and multimedia – Data base Management systems – Creating computer program.

UNIT III**9**

C programming fundamentals – compilation process – variables – Data types – Expressions – looping – decisions.

UNIT IV**9**

Arrays - Working with functions – structures – character strings – pre processor.

UNIT V**9**

Pointers – Dynamic memory allocation – linked list - Applications

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Peter Norton, “Introduction to Computers”, Sixth Edition, Tata McGraw Hill, 2007.
2. Stephen G. Kochan, “Programming in C”, Third Edition, Pearson Education, 2007.

REFERENCES

1. B.W.Kernighan and D.M.Ritchie, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Kenneth A. Reek, “Pointers on C”, Pearson Education, 2007.
4. R.G.Dromey, “How to solve it by Computer”, Pearson Education, 2007.

OBJECTIVE:

To impart the knowledge on basic concepts of electrical circuits, electromagnetism and electrical machines

UNIT I BASIC CONCEPTS AND DC CIRCUITS 9

Ohm's law - Electrical resistance - Series /Parallel resistive circuits - Star/Delta transformations - Kirchoff's law - Node and Mesh analysis - Thevenin's and Norton's theorem.

UNIT II ELECTROMAGNETISM 9

Magnetic flux - MMF - Flux density - B H curves - Simple and Composite magnetic circuits - Statically induced EMF - Self and Mutual Inductances - Coupling coefficient - Stored energy - Force on a conductor - Magnetic pull - Force between parallel conductors.

UNIT III A.C.CIRCUITS 9

RMS and average value of periodic waves - Form factor - Phase and Phase difference - Simple RC, RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three phase systems – power measurement in 3 phase system.

UNIT IV D.C. MACHINES 9

Construction details of DC machines - principle of operation of DC generator - EMF equation - characteristics of DC generators - principle of DC motor - Back EMF - Voltage and torque equation - Characteristics of shunt, series and compound motors.

UNIT V A.C. MACHINES 9

Principle of ideal transformer - construction and type - EMF equation - Tests on transformer - Equivalent circuit - Voltage regulation - Construction of synchronous machines - Principle of alternator - EMF equation - Torque equation - V-curves - Induction motor - Construction and basic principle of operation slip - Starting and Running torques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Theraja, B.L., " A Text Book of Electrical Technology ", Vol ;1 & 2, 24th edition S.S.Chand and Co., New Delhi, 2005
2. Edminister J.A., " Theory and Problems on Electric circuits ", McGraw Hill International Edition, 1994.

REFERENCES:

1. Kosow, I.L., " Electrical Machinery and Transformers ", 4th Edition, Prentice Hall of India, 1991.
2. Nagrath I.J. and Kothari D.P., " Theory and Problems of Basic Electrical Engineering ", Prentice Hall of India, 1998.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10 +3

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 – Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 8 + 3

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9 + 3

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 + 3

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 + 3

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: 60 PERIODS**TEXT BOOKS:**

1. Grewal, B.S. and Grewal, J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers", 3rd Edition Prentice Hall of India Private Ltd., New Delhi, 2007.

REFERENCES:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, 2007.

OBJECTIVE:

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

UNIT I BASICS & STATICS 12

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

UNIT II EQUILIBRIUM OF RIGID BODIES 12

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

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

UNIT IV DYNAMICS OF PARTICLES 12

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

UNIT V CONTACT FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR9211**ENGINEERING METALLURGY****L T P C
3 0 0 3****OBJECTIVE:**

- (i) To introduce the various concepts of metallurgy, metallurgical Structures and mechanical properties, testing of metals
- (ii) To impart the knowledge on metallurgy with respect to foundry and welding processes

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfection, point, line, planar and volume defects – Grain size, ASTM grain size number. Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Charbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT II HEAT TREATMENT 10

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, 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, Induction Laser and Electron beam and plasma phase hardening – Special and Duplex surface hardening processes.

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA – maraging steels – Gray, white, malleable spheroidal, graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Alloys of Ti, Zn Mg and Ni – Intermetallics, Ni, Ti Aluminides – Shape memory alloys.

UNIT IV MECHANICAL PROPERTIES AND TESTING 8
 Mechanism 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 test impact test, Izod and charpy, fatigue and creep mechanisms – types of wear – preventions.

UNIT V WELDING AND FOUNDRY METALLURGY 8
 Weld thermal cycle – Microstructure of HAZ in Steel and Aluminium alloys – weldability of steel, cast iron and non-ferrous alloys – Pre and Post weld heat treatment – Residual stress and distortion – casting solidification – Formation of dendrite, columnar and equiaxed grains – castability of steel, cast iron, Stainless Steel Al and Cu alloys.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald R.Askeland – The Science and Engineering of materials – 4th Edition – Thomson Engineering – 2002
2. Keneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004”.

REFERENCES:

1. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Co., 2001
2. Raghavan V. Materials Science & Engg” Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister “Material Science & Engg – John Wiley & Sons, 2002
4. L.H.Van Vlack, “Materials Engg. Concepts and Applications, 2001.

PTPR9253 FOUNDRY AND WELDING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

To understand the principle, procedure and applications of Foundry and Welding Processes

UNIT I CASTING PROCESS 10
 Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and 3 box moulding processes, runner, riser and gate.

UNIT II WELDING PROCESSES 9
 Introduction to soldering, brazing and welding types of joining – plane of welding – edge preparation – filler material – flux – shielding gases – fusion welding – gas welding – gas flame types – Manual arc welding – arc theory – power supply – braze welding – Thermit welding – Resistance welding – spot, seam, projection, percussion & flash.

UNIT III SPECIAL CASTING PROCESSES 8
 Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO₂ moulding – Plaster mould castings – Antioch process – Slush casting.

UNIT IV SPECIAL WELDING PROCESSES 9
Atomic H₂ arc welding – Shielded gas arc welding GMAW & GTAW – Submerged arc welding – Electro slag welding – friction welding – explosive welding – Underwater welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding.

UNIT V TESTING OF CASTINGS & WELDMENTS 9
Causes and remedies for casting defects – welding defects – Destructive testing – NDT – Dye penetrant – magnetic particle – X-ray, ultrasonic cell – studies in testing of joints & castings.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Welding Engineering & Technology R.S.Parmer – Khanna Publishers – 2002.
2. Principle of metal casting – Heime, Looper and Rosenthal – Tata McGraw Hill – 2001

REFERENCES

1. Principle of Foundry Technology – P.L.John Tata McGraw Hill – 2003
2. Modern Welding Technology – B.Curry – Prentice Hall – 2002
3. Welding Principle & applications – Larry Jeff in Delmar – 1997
4. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 93

PTPR9256

METALLURGY LABORATORY

L T P C
0 0 3 2

OBJECTIVES

- (i) To train the students in observation and interpretation of Microstructure of Engineering materials.
- (ii) To train students in Heat treatment, hardenability and surface treatment of Engineering Materials
- (iii) To train the students in testing of Foundry sand

LIST OF EXPERIMENTS:

1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
 - a) Carbon steel s(High, Medium, and Low)
 - b) Cast Iron (Gray, White, Nodular, Malleable)
3. Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
4. Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.
5. Cooling curves
 - a) Pure Metal (Pb or Sn)
 - b) Alloy (Pb-Sn or Pb-Sb)
6. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)
 - a) Annealing
 - b) Normalising
 - c) Quench Hardening
 - d) Tempering
7. Jominy End Quench Test
8. Foundry Sand testing

- a) Sieve analysis
 - b) Strength of moulding sand
 - c) Permeability of moulding sand
 - d) Clay content of moulding sand
 - e) Moisture content of moulding sand
9. Electro-chemical Test
- a) Electro deposition
 - b) Electro-chemical etching test

TOTAL: 45 PERIODS

PTPR9251

THEORY OF MACHINES

L T P C
3 1 0 4

OBJECTIVES:

To understand the basic concepts of mechanisms and machinery

- UNIT I MECHANISMS 14**
 Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.
- UNIT II FRICTION 12**
 Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.
- UNIT III GEARING AND CAMS 12**
 Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.
- UNIT IV BALANCING 11**
 Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.
- UNIT V VIBRATION 11**
 Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Bansal Dr.R.K. “ Theory of Machines” Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S.”Theory of machines” Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES:

1. Rao J.S. and Dukkupati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989
4. Shigley J.E. and Uicker J.J. Theory of Machines and Mechanisms" McGraw Hill, 1986.

PTPR9304**QUANTITATIVE TECHNIQUES IN MANAGEMENT****L T P C****3 1 0 4****OBJECTIVE:**

To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular

UNIT I LINEAR PROGRAMMING 10

Problem formulation - Graphical method – simplex method – Special cases – sensitivity analysis - transportation and assignment method – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY 8

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 9

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING AND SEQUENCING 9

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach

UNIT V PROJECT NETWORK ANALYSIS, LINE BALANCING AND DECISION TREE ANALYSIS 9

Network – CPM/PERT – Project time estimation – critical path – crashing of network; line balancing – applications; Decision tree analysis – applications

TOTAL: L + T = 60 PERIODS**TEXT BOOKS:**

1. R. Panneerselvam, Operation Research, Prentice Hall of India, 2002

REFERENCES:

1. P.K.Guptha and Man-Mohan, Problems in Operations Research-Sultan chand & Sons, 1994
2. MONKS J.G. – Operations Management theory and Practice, McGraw Hill, 1992
3. Ravindran, Philips and Sojberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
4. J.K. Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
5. Hamdy A.Taha, Operations Research – An Introduction, Prentice Hall of India, 1997.

OBJECTIVES:

- (i) To understand the working principle of hydraulic and pneumatic components and its selection
- (ii) To design hydraulic and pneumatic circuits for different applications

UNIT I INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE 8

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria, Application of Fluid power, Application of Pascal's Law, equation, Transmission and multiplication of force – Pressure Losses – Fluids, selection & properties – ISO symbols.

UNIT II FLUID POWER DRIVES 10

Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III FLUID POWER ELEMENTS 10

Control valves – pressure, flow, direction - working principle and construction – Special type - valves – Cartridge, modular, proportional, and servo – Selection and actuation methods. Actuators – Selection and specification, cylinders, mounting, cushioning, pipe fittings – Fluid conditioning elements – Accumulators.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 10

Design of Hydraulic and pneumatic circuits for automation, selection and specification of circuit components, sequencing circuits, cascade, and karnaugh – Veitch map method – Regenerative, speed control, synchronizing circuits.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 7

Use of electrical timers, switches, solenoid, relays, proximity sensors etc. electro pneumatic sequencing Ladder diagram – PLC – elements, functions and selection – PLC programming – Ladder and different programming methods - Sequencing circuits.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Anthony Esposito "Fluid power with applications", 5th editor, Pearson education 2003.
2. Majumdar, "Oil hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004

REFERENCES:

1. William W.Reaves, Technology of Fluid Power, Delmer Publishers, 1997.
2. Petor Rohner, Fluid Power Logic circuit, Design Macmillon Press Ltd., 1990.
3. Andrew Parr "Hydraulics & Pneumatics, Jaico Publishing House, 2004

UNIT I AXIAL LOADING 12

Stresses and strains – Hooke's law – stress and strain diagrams - elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

UNIT II STRESSES IN BEAMS 10

Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

UNIT III DEFLECTION OF BEAMS 12

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications.

UNIT IV TORSION – SPRINGS – COLUMNS 14

Torsion of solid and hollow circular shafts – shear stress variation – power transmission in shafts – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT V BIAXIAL STRESSES 12

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr's circle and its construction – determination of principal stresses.

TOTAL: 60 PERIODS**TEXT BOOKS:**

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004

REFERENCES:

1. Dym, C.L., and Shames, I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. R.K. Rajput, 'Strength of Materials', S. Chand and Co., 1999.
4. Timoshenko, S. and Young, D.H., Elements of Strength of Materials, T. Van Nostrand Co. Inc., Princeton, N.J., 1977.

OBJECTIVES:

- (i) To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
- (ii) To train the students in designing different pneumatic and hydraulic circuits for different application.

LIST OF EXPERIMENTS

1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.

4. Simulation of single and double acting cylinder circuits using different directional control valves
5. One shot and regenerative pneumatic circuits
6. Sequencing of pneumatic circuits
7. Simulation of Electro-pneumatic latch circuits
8. Simulation of Logic pneumatic circuits
9. Simulation of electro pneumatic sequencing circuits
10. Simulation of PLC based electro pneumatic sequencing circuits
11. Simulation of pneumatic circuits using PLC

TOTAL: 45 PERIODS

PTPR9303

MACHINE DESIGN

L T P C
3 1 0 4

OBJECTIVE:

To introduce students to the design and theory of common machine elements and to give students experience in solving design problems involving machine elements.

UNIT I INTRODUCTION 9+3

Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Selection of Materials –Design against Static and Dynamic Load –Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT II DETACHABLE AND PERMANENT JOINTS 9+3

Design of Bolts Under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subjected to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints

UNIT III SHAFTS, COUPLING AND BRAKES 9+3

Design of Shaft –For Static and Varying Loads, For Strength and Rigidity-Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling-Design of Brakes-Block and Band Brakes

UNIT IV GEARS AND BELT DRIVES 9+3

Design of Spur, Helical, Bevel and Worm Gear drives-Design of Belt drives-Flat and V Belts

UNIT V SPRINGS AND BEARINGS 9+3

Design of Helical Spring-Types, Materials, Static and Variable Loads-Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Joseph Edward Shigley, Charles R. Mischke “ Mechanical Engineering Design”, McGraw Hill, International Edition, 1992

REFERENCES:

1. V.B.Bhandari, “ Design of Machine Elements”, Tata McGraw-Hill Publishing Company Limited, 2003.
2. C.S.Sharma and Kamlesh Purohit, “ Design of Machine Elements”, Prentice Hall of India Private Limited, 2003
3. Robert L.Norton, “Machin Design – An Integrated Approach”, Prentice Hall International Edition, 2000.

PTPR9401

**MANUFACTURING PROCESS PLANNING
AND COST ESTIMATION**

**L T P C
3 1 0 4**

AIM:

To evaluate a product in monetary units

OBJECTIVES:

- (i) To develop a good process planner
- (ii) To impart the knowledge on good estimation of engineering product

PRE-REQUISITES:

Students must have sound knowledge on various manufacturing processes

UNIT I PROCESS PLANNING 9

Definition – Information required and advantages – process planning activities and chart – logical design of a process plan (for machining process), covering preliminary analysis, selection of machining process, machine tools, grouping of jobs, Anteriorities table and anteriority matrix for sequencing.

Primary process selection – Rough and Refined rules - Selection of casting process – Selection of forming process – Selection of machining process – examples – Manual process planning – case studies – short comings of Manual process planning – Computer aided process planning – variant, generative and semi generative.

UNIT II ESTIMATING, COSTING AND ELEMENTS OF COST 9

Importance and aims of cost estimation – Functions of estimation – costing – importance and aims of costing – Difference between costing and estimation – Importance of realistic estimates – Estimation procedure – Elements of cost – Material cost – Determination of Material cost – labour cost – determination of direct labour cost – Expenses – Cost of product (Ladder of cost) – Illustrative examples.

UNIT III ANALYSIS OF OVERHEAD EXPENSES & METHODS OF DEPRECIATION 8

Overhead expenses – Factory expenses – Administrative expenses – Selling and Distributing expenses – Allocation of overhead expenses – Depreciation – Causes of depreciation – Methods of depreciation.

UNIT IV ESTIMATION OF COSTS FOR FORGING, CASTING AND WELDING 10

Estimation of forging cost – Forging process – Forging operations – Losses in forging operations – Calculating forging cost – Illustrative examples – Estimation in Foundry shop – Introduction – Steps involved in making a casting – Patterns – Pattern allowances – Estimation of pattern cost – Foundry losses – Steps for calculating casting costs – Illustrative examples. Estimating welding costs – Introduction – Arc welding costs – Basic costing procedure (Arc welding) – Gas Welding – Basic costing procedure (Gas welding) – Factors affecting welding cost – Thermal cutting of Metals – Illustrative examples.

UNIT V ESTIMATION OF MACHINING TIME AND ESTIMATION IN SHEET METAL SHOP 9

Estimation in Machine-shop – Introduction – Machining times and allowances – General term related to machining – calculation of machining time – Estimation of time for lathe operations – estimation of machining time for drilling, shaping, slotting, planing, grinding, and milling operations – Illustrative examples.

Estimation in sheet metal shop – Introduction – Development of product – sheet metal operations – sheet metal joints – Press working operations – Layout of blank – Press capacities – Estimation of time – Illustrative examples.

TOTAL: L + T= 60 PERIODS

TEXT BOOKS:

1. O.P. Khanna, "Mechanical Estimating and Costing", Dhanpat Rai publishers, 1999
2. R. Kesavan, C.Elenchezian, and B.Vijaya Ramnath, "Process Planning and cost estimation", New age International publishers, 2005

REFERENCES:

1. G.B.S. Narang and V.Kumar, "Production and costing", Khanna publishers, 2000
2. Mikell P. Groover, "Automation, production systems and computer – Integrated Manufacturing", Prentice-Hall of India Private Limited, 2003
3. P. Radhakrishnan, S. Subramanyan and V. Raju, "CAD/CAM/CIM", New Age International Publishers, 2000
4. Gideon Halevi & Roland D.Weill, "Principles of process planning", Chapman & Hall, 1995.
5. M. Adithan & B.S. Pabla, "Production Engineering Estimating and costing", Konark publishers Pvt. Ltd., 1990.

**PTPR9255 METAL FORMING PROCESSES L T P C
3 0 0 3**

OBJECTIVES:

To understand the principle, procedure and applications of Bulk Metal Forming and Sheet Metal Forming

UNIT I FUNDAMENTALS OF METAL FORMING 10

State of stress – Components of stress, symmetry of stress tensor, principal stresses – Stress deviator – von-mises, Tresca yield criteria – Octahedral shear stress and shear strain theory – Flow stress determination – Temperature in metal forming – Hot, cold and warm working – strain rate effects –metallurgical structures – residual stresses – Spring back.

UNIT II FORGING AND ROLLING 10
Principle – classification – equipment – tooling – processes parameters and calculation of forces during forging and rolling processes – Ring compression test - Post forming heat treatment – defects (causes and remedies) – applications – Roll forming.

UNIT III EXTRUSION AND DRAWING PROCESSES 10
Classification of extrusion processes – tool, equipment and principle of these processes – influence of friction – extrusion force calculation – defects (causes and remedies) – Rod/Wire drawing – tool, equipment and principle of processes – defects – Tube drawing and sinking processes – mannsmann process of seamless pipe manufacturing – Tube bending.

UNIT IV SHEET METAL FORMING PROCESSES 10
Classification – conventional and HERF processes – presses – types and selection of presses – formability studies – FLD, Limiting Draw ratio - processes: Deep drawing, spinning, stretch forming, plate bending, Rubber pad forming, bulging and press brake forming – Explosion forming, electro hydraulic forming, Magnetic pulse forming.

UNIT V RECENT ADVANCES 5
Super plastic forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming - P/M forging – Isothermal forging – high speed hot forging – near net shape forming high velocity extrusion – CAD and CAM in forming

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dieter G.E., “Mechanical Metallurgy”, McGraw Hill, Co., S.I. Edition, 2001
2. Nagpal G.R. “Metal forming processes”, Khanna publishers, New Delhi, 2004

REFERENCES:

1. Serope Kalpakjian, Steven R Schmid, “Manufacturing Process for Engineering Materials” – Pearson Education, 4th Edition, 2003.
2. Rao, P.N. “Manufacturing Technology”, TMH Ltd., 2003
3. Edward M.Mielink, “Metal working science Engineering, McGraw Hill, Inc, 2000.
4. Metal Hank book Vol.14, “Forming and Forging”, Metal Park, Ohio,USA, 1990

PTPR9302 METROLOGY & COMPUTER AIDED INSPECTION L T P C
3 0 0 3

OBJECTIVE:

- (i) To know the working principle of all metrology instruments
- (ii) To impart knowledge and importance of Metrology in achieving quality products, to understand the various measuring instruments and also the latest laser metrology concepts

UNIT I GENERAL CONCEPTS OF MEASUREMENTS 8
Definition – Standards of measurement – Errors in measurement – Limits, fits, tolerances and gauge design – Interchangeability and Selective Assembly – Accuracy and precision – calibration of Instruments – Principles of light interference – Interferometry – measurement of absolute length using interferometers.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 10

Slip gauges, micrometers, verniers, dial gauges and surface plates – comparators – mechanical electrical, optical and pneumatic comparators – Angular measuring instruments – Angle gauges – sine bar – precision spirit level – Autocollimator – Angle dekkor – clinometers – Straightness and flatness measurement using precision level and Autocollimator.

UNIT III MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Surface finish – Definitions – types of surface texture – surface roughness measurement methods – comparison – profilometer – surface roughness measuring instruments – measurement of Run-out and concentricity – straightness – flatness and alignment errors – Tool makers microscope–optical and Laser Alignment Telescopes–metroscope.

UNIT IV METROLOGY OF SCREW THREAD & GEARS 9

Internal & External screw thread – Terminology – Measurement of various elements of screw threads – thread micrometer – two wire and three wire methods – Gear terminology – measurement of various elements of gears – constant chord method – Base tangent method plug method – Rolling gear tester.

UNIT V COMPUTER AIDED INSPECTION AND LASER METROLOGY 9

Co-ordinate measuring machines – Probe sensors – errors – environmental factors - Laser micrometer – Laser interferometer – Testing straightness and angle measurement using laser – Non-contact and in process inspection using Laser – Alignment testing and machine tool metrology – vision system – industrial applications of vision systems – Atomic force microscope – scanning tunneling microscope

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gupta I.C. A Text Book of Engineering metrology, Dhanpat Rai and Sons, 1996.

REFERENCES:

1. Jain R.K. Engineering Metrology Khanna publishers, 2002
2. G.N. Gaylor and C.R. Shot Bolt “Metrology for Engineers” ELBS 1990
3. “ASTE Hand Book of Industrial Metrology” Prentice Hall of India Limited, 1992.
4. Manuals of Laser Interferometer – Hew let & Packard

PTPR9357

METROLOGY & INSPECTION LABORATORY

**L T P C
0 0 3 2**

LIST OF EXPERIMENTS

1. Measurements of angle using Sine bar / bevel protractor
2. Measurement of External and internal Taper angle
3. Measurement of Bore Diameter
4. Calibration of Dial gauge
5. Measurement of Roundness
6. Measurements of Screw Thread Parameters using three-wire method
7. Measurements of Surface Roughness
8. Measurements using toolmaker Microscope
9. Measurements using Profile Projector
10. Measurements using Vision Measuring System
11. Measurements using CMM

TOTAL: 45 PERIODS

OBJECTIVES:

- (i) To understand the theory of metal cutting
- (ii) To understand the concepts of gear manufacture
- (iii) To understand CNC machines constructional features, working and programming

UNIT I MECHANICS OF METAL CUTTING 10

Cutting tool angles – tool signature – orthogonal & oblique cutting – cutting forces, Merchant circle diagram – force & velocity relation.

UNIT II TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

Requirement of tool materials – types of tool materials – Tool wear – Types, mechanism – Tool life - Machinability - types of chips – cutting fluids.

UNIT III GEAR MANUFACTURE 8

Different methods of gear manufacture – Gear hobbling and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – Interchangeable tooling system – preset & qualified tools – ISO specification – Machining center – Turning center – CNC wire cut EDM.

UNIT V CNC PROGRAMMING 9

Manual part programming – steps involved – sample program in lathe & milling. - Computer aided part programming – APT program - CAM package – canned cycles — Programming.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Hazlehurst M, "Manufacturing Technology", - EI.BS, 1978
2. Jonathan Lin.S.C., Computer Numerical Control from Programming to Networking, Delmar Publishers, 1994

REFERENCES:

1. Groover.M.P., Automatic production systems and computer integrated manufacturing, Prentice Hall , 1990.
2. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991
3. Hajra Choudhury C.J., "Elements of Workshop Technology", Vol.I and Vol.II, Asia Publishing House, 1992.
4. Nagpal G.R., Machine Tool Engineering, Khanna Publishers, 2002

OBJECTIVES:

To train production Engineer to manage industrial scenario

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

General principles of management – management functions – organization – types – comparison – functions of personnel management – recruitment training leadership/motivation – communication – Conflict - Industrial relations – trade union.

UNIT II INVENTORY MANAGEMENT 11

Purpose of Inventory – Cost related to inventory – Basic EOQ model – variations in EOQ model – Finite Production, quantity discounts – ABC Analysis – MRP

UNIT III OPERATIONS MANAGEMENT 10

Plant Location – Layout – Materials Handling – Method Study – Time Study – Ergonomics – Aggregate Planning – Value Analysis

UNIT IV FINANCIAL MANAGEMENT 10

Capital – Types – sources – break even analysis – financial statements – income statement – balance sheet – capital budgeting – working capital management – inventory pricing.

UNIT V MARKETING MANAGEMENT 7

Functions of marketing – Sales promotion methods – advertising – product packaging – marketing variables – distribution channels – organization – market research - market research techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering management – Eswar Press, 2005
2. R. Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003

REFERENCES:

1. Koontz and Odonnell-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995
3. I.M. Pandey – Financial Management, Vikas Publishing house, 1995
4. K.K.Ahuja – Personnel Management, Kalyane Publication 1992
5. K.Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003
6. Martand T. Telesand – Industrial and Business management – S.Chand & Co., 2001
7. R. Kesavan, C.Elanchezhian and B.Vijayaramnath – Production Planning and Control, Anuratha Publishing Co. Ltd., Chennai - 2008

PTPR9353 DESIGN OF JIGS, FIXTURE, PRESS TOOLS & DRAWING L T P C
3 1 0 4

OBJECTIVE:

- (i) To introduce the concepts of various types of jigs, fixtures and dies
- (ii) To design and draw jig / fixture/ die for a given component

UNIT I LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES 9+3

Principles of Jigs and Fixture – Design concepts – Different types of locating devices – different types of clamps – Drill bushes – types – Elements of fixtures.

UNIT II DESIGN OF ELEMENTS OF JIGS AND FIXTURE 9+3

Design concepts of Template Jig, Plate Jig, Sandwich Jig, Vice Jaw Jig, Latch Jig, Turnover jig, Box jig – Fixtures for Milling, Grinding, Turning, Welding, and Assembly – Modular fixtures.

UNIT III PRESS WORKING OPERATION AND FORMING DIES 9+3

Blanking, Piercing, lancing, notching, bending design features of dies for drawing, extrusion, wire drawing and forging.

UNIT IV ELEMENTS OF DIE 9+3

Design concepts of the following elements of progressive, compound and Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

UNIT V DESIGN AND DRAWING DIES, JIGS AND FIXTURES 9+3

Progressive die – compound die – Bending and drawing dies – Drill Jigs – Milling fixtures, turning fixtures.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Donaldson, B.H. Lecain, Goid V.V., Tool Design, TMH Edition, 1978.

REFERENCES:

1. Handbook of metal forming, Kurt Lunge, McGraw Hill, Pub.Co. 1985.
2. Paquin, Die Design Fundamentals, Industrial Press Inc, New York, 1979
3. ASTME, Fundamentals of Tool design, Prentice Hall 1974
4. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976

OBJECTIVES:

- (i) To provide an introduction to fundamental concepts of statistical process control
- (ii) Enhance the student understanding of the complexities of Statistical analysis and control chart interpretation
- (iii) To understand the concept of reliability and its improving techniques and design of experiments

UNIT I SAMPLING THEORY AND TESTING OF HYPOTHESIS 11

Population, sample – influence of sample size – Estimation of population parameter from sample – mean and variance, difference of means, variances and ratios of variances – Tests of hypothesis – large and small samples – Chi-square distribution – F distribution.

UNIT II STATISTICAL PROCESS CONTROL 15

Variation in process – Factors – control charts – variables \bar{X} R and \bar{X}, σ , - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT III ACCEPTANCE SAMPLING 15

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL end LTPD – use of standard sampling plans – Sequential sampling plan.

UNIT IV RELIABILITY AND QUALITY 10

Life testing – failure characteristics – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques - Pareto analysis.

UNIT V EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

TOTAL: 60 PERIODS**TEXT BOOKS:**

1. Amcta Mitra "Fundamentals of Quality Control and improvement" Pearson Education, 2002.

REFERENCES:

1. Bester field D.H., "Quality Control" Prentice Hall, 7th edition 2003
2. Manohar Mahajan, "Statistical Quality Control", Dhanpal Rai & Sons, 2001.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publications, 2004.

PTPR9355

CNC LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Study of different control systems and NC codes.
2. Program for Turning, Facing operation.
3. Program for circular interpolation, Taper turning operation
4. Program for thread cutting operation
5. Program using Do-Loop and Sub-routine.
6. Program for profile milling operation, circular interpolation
7. Program for Circular, rectangular pocket milling
8. Program for drilling cycle
9. Program for tool compensation and Program offset
10. NC code generation using CAD software packages
11. Study of cam packages
12. Study of CNC Wire cut EDM

TOTAL: 45 PERIODS

PTPR9354

**AUTOMATED PRODUCTION & COMPUTER INTEGRATED
MANUFACTURING**

L T P C
3 0 0 3

AIM:

To impart the knowledge of computer technology in all of the operational and information processing activities related to manufacturing.

OBJECTIVES:

- (i) To understand the various automated manufacturing activities
- (ii) To study the application of computer Technology in the
- (iii) manufacturing activities
- (iv) To know the smooth transition from conventional manufacturing to automated production and computer integrated manufacturing

PRE-REQUISITES:

Students must have sound knowledge on various manufacturing types, – system and operations

UNIT I

INTRODUCTION

8

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and software – three step process for implementation CIM – production concepts and mathematical models covering production rate, manufacturing lead time, capacity utilisation, availability & WIP – Automation – Reason for Automation and Automation strategies – The future automated factory.

UNIT II AUTOMATED PRODUCTION SYSTEMS AND MATERIAL HANDLING AND STORAGE SYSTEM 10

Basic elements of an automated system – Advanced automated functions – Levels of Automation - Fundamentals of Automated Production Lines – Work part Transfer Mechanisms – Storage Buffers – Control of the Production Line – Application to Machining System.

Factors influencing material handling system – 10 principles of Material handling – Material transport system – Industrial Trucks, Mono-rails and other rail-guided vehicles, conveyors, cranes & Hoists – Automated guided vehicle system – Types. Guidance technology, vehicle management, despatch rules and safety.

Storage systems – Performance, storage location strategies, conventional methods – Automated Storage and Retrieval systems – carousel storage systems.

UNIT III GROUP TECHNOLOGY AND CELLULAR MANUFACTURING 9

Part families – visual – parts classification and coding – case studies in coding – Production flow analysis – benefits of G.T. – Application of G.T.

Cellular Manufacturing – Composite part concept – Machine cell design – Key machine concept - quantitative analysis in cellular manufacturing – Rank order clustering technique – Arranging machines in G.T. Cell – Hollier method 1 and 2.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM 9

What is an FMS? – Types of FMS – FMS components – Workstations, Material Handling and storage system – FMS Layout type, computer control system, Human resource – Flow chart showing various operations in FMS – Dead lock in FMS – FMS application and benefits – FMS planning and implementation issues. Quantitative analysis of FMS – various bottle neck model – Sizing the FMS – Illustrative examples.

UNIT V AUTOMATED ASSEMBLY, COMPUTER PROCESS CONTROL AND SHOP FLOOR CONTROL 9

Automated assembly – Fundamental – system configuration, part delivery at work station – Design for automated assembly Computer process control – continuous, discrete process, control requirement, capabilities, Level of process control – Computer process control – Computer process interface, computer process monitoring, Direct Digital control, Supervisory control – Distributed control system and personal computer.

Short floor control – Three phases – Factory data collection – manual method – Automated and semiautomated data collection (ADC) – Bar code technologies and other ADC Technologies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mikell P.Groover, "Automation, Production Systems and Computer-integrated Manufacturing", Prentice Hall of India Private Limited, 2003

REFERENCES:

1. Radhakrishnan.P, Subramanyan.S and Raju.V, "CAD/CAM/CIM", New Age International Publishers, 2000
2. James A.Reitg and Henry W. Kraebher, "Computer Integrated Manufacturing", Pearson Education, Asia, 2001
3. Viswamathan.N and Narahari.Y, "Performance modelling of automated manufacturing system", Prentice Hall of India Private Limited, 1994.

AIM:

To understand the basic principle and production methods of automotive components.

OBJECTIVE:

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

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.

OBJECTIVES:

To introduce the concept of FEM and to apply in the field of Manufacturing Engineering

UNIT I INTRODUCTION 9

General field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method-variational calculus-Variational formulation of boundary value problems-The method of weighted residuals-Rayleigh-Ritz and Galerkin methods-Solution of large system of equations-Choleski Decomposition-Gaussian elimination procedures.

UNIT II GENERAL PROCEDURE OF FET 9

Discretization of Domain selection of interpolation polynomials-Convergence requirements-Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results.

UNIT III FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO DIMENSIONAL PROBLEMS 10

One dimensional finite element analysis-Linear bar element-Quadratic bar element-Beam element-Frame elements-One dimensional heat transfer-Two dimensional finite element analysis approximation of geometry and field variables-Three noded triangular element-Four noded rectangular element-Six noded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions

UNIT IV ISO-PARAMETRIC ELEMENTS 9

Iso-parametric elements-Dynamic analysis-Equations of motion using Lagrange's approach-Consistent and Lumped mass matrices-Formulation of FE equations for vibration problems-Solution of Eigen value problems-Transient vibration analysis-Thermal transients.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS 8

Finite element analysis of Machine elements - Axi-symmetric FEA of a pressure vessel-Application of FEM in various metal forming processes – Solid formulation and flow formulation – FEA simulation of Metal cutting, Solidification of castings and Weldments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", Prentice Hall of India, 1997.
2. Reddy.J.N., "An Introduction to Finite Element Method" McGraw Hill, International Student Edition, 1993.

REFERENCES:

1. Rao.S.S., "The Finite Element Method in Engineering", Pergamon Press, 1993.
2. Segarland. L.J., "Applied Finite Element Analysis", John Wiley and Sons, Inc.
3. Seshu.P., "Text Book of Finite Element Analysis", Prentice Hall of India, 2003
4. Rajasekaran.S., "Numerical Methods for Initial and Boundary Value Problems", Wheeler and Co., Pvt. Ltd., 1987
5. Lewis R.W., Morgan K., Thomas H.R. and Seetharamu K.N., The Finite Element Method in Heat Transfer Analysis, John Wiley & Sons Ltd., 1996.

PTPR9306

COMPUTER AIDED DESIGN LABORATORY

L T P C
0 0 3 2

AIM:

To impart practical knowledge in modeling.

OBJECTIVE:

1. To get hands on experience in modeling of automotive, typical industrial components, etc.
2. To practice Solid Works, CATIA, Pro-E for the above.

LIST OF EXPERIMENTS

1. 2 D Modeling of automotive components using Solid Works.
2. 3 D Modeling of components using Pro-E
3. 3 D Modeling of industrial components using Solid Works.
4. Assembly modeling of typical parts using Solid Works.
5. Assembly modeling of typical parts using CATIA
6. Sheet metal modeling using CATIA

TOTAL: 45 PERIODS

PTPR9352

COMPUTER AIDED PRODUCT DESIGN

L T P C
3 0 0 3

OBJECTIVE:

- (i) To introduce the concepts and applications of CAD
- (ii) To introduce the various concepts and techniques used for Product design and to develop product design skills.

UNIT I INTRODUCTION TO COMPUTER AIDED DESIGN 8

Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT II COMPUTER GRAPHICS FUNDAMENTALS 8

Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves – Bezier, B-Spline and NURBS – Concepts.

UNIT III GEOMETRIC MODELING 9

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages

UNIT IV PRODUCT DESIGN CONCEPTS 12

Product modeling – types of product models; product development process tools – TRIZ – Altshuller's inventive principles – Modeling of product metrics – Design for reliability – design for manufacturability – machining, casting, and metal forming – design for assembly and disassembly - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

UNIT V PRODUCT DATA MANAGEMENT 8
Product Data Management – concepts – Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, 2000

REFERENCES:

1. Biren Prasad, "Concurrent Engineering Fundamentals Vol.11", Prentice Hall, 1997.
2. James G.Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1994
3. Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.
4. David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 1990

**PTPR9404 INDUSTRIAL ROBOTICS LT P C
3 0 0 3**

UNIT I FUNDAMENTALS OF ROBOT 7
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 10
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, 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 of a gripper - gripper force calculation and analysis.

UNIT III SENSORS IN ROBOTICS 8
Force sensing, touch and tactile sensors, proximity sensors, non contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism
Machine vision system - 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 servoing and navigation.

UNIT IV ROBOT KINEMATICS AND PROGRAMMING 12
Forward kinematics, inverse kinematics and the difference: forward kinematics and Reverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.
Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programmes.

UNIT V APPLICATIONS OF ROBOT

8

Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Groove M.P., Industrial Robotics – Technology, Programming and applications, McGraw Hill.

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G.Robotics Control, Sensing, Vision and Intelligence, McGraw Hill book co., 1987.
2. Yoram Koren, Robotics for Engineers, McGraw Hill Book, Co., 1992
3. Janakiraman P.A., Robotics and Image Processing, Tata McGraw Hill 1995.

PTPR9451

PROJECT WORK

**L T P C
0 0 12 6**

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a guide who is a member of the faculty of the University. Twelve periods per week shall be allotted in the Time Table for this important activity and the students to receive directions from the guide, on library reading, laboratory work, and computer analysis, shall utilize this time. Or fieldwork as assigned by the guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature-survey, problem statement, project work details, estimation of cost and conclusion. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

TOTAL: 180 PERIODS

OBJECTIVES:

To impart knowledge in the increasing quality concepts of parts, accuracy requirement of machine tools and also to introduce latest topics in Manufacturing like micro machining and smart materials so as to equip them to join core electronic manufacturing industries.

UNIT I CONCEPTS OF ACCURACY AND MACHINE TOOLS 9

Part Accuracy – errors, accuracy of machine tools – spindle accuracy – displacement accuracy – errors due to numerical interpolation – definition of accuracy of N.C system – errors in the NC machines – feed stiffness – zero stability.

UNIT II STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING 12

Overall stiffness of Lathe – compliance of work piece – errors caused by cutting forces – deformation in turning – boring – milling – heat sources – thermal effects – Finish Turning, boring, grinding – Surface roughness.

UNIT III DIMENSIONING 6

Definition of terms – Key dimension – Superfluous dimension – dimensional stepped shaft – assigning tolerances in the constituent dimensions – dimensional chains.

UNIT IV MICRO-MACHINING MICRO FABRICATION 9

Micro Machining – Photo resist process – Lithography – LIGA Process – Optical, processing of materials – electron beam machining – beam machining – micro forming, diamond turning – micro positioning devices – etching – physical vapour deposition – Chemical vapour deposition

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 9

Smart structures – Smart materials types and applications - smart sensors – micro valves – MEMS – Micro motors – Micro pumps – micro dynamometer – micro machines – micro optics – micro nozzles.

TOTAL: 45 PERIODS

TEST BOOKS:

1. Murthy R.L. "Precision Engineering in Manufacturing", New Age International Pvt. Limited. (19
2. Juliar W.Gardner. Vijay K. Varadan, 'Micro sensors, MEMS and Smart Devices, John wiley and sons, 2001.

REFERENCES:

1. Stephen A.Campbell, "The Science and Engineering of Micro electronic Fabrication", Oxford University Press, 1996.
2. Raady Frank, "Understanding smart sensors", Artech. House, Boston, 1996.
3. MEMS Hand Book, CRC Press, 2001

UNIT I INTRODUCTION 9

Static and dynamic characteristics of measurement systems, standards and calibration, error and uncertainty analysis, statistical analysis of data, and curve fitting.

UNIT II MECHANICAL MEASUREMENTS AND INDUSTRIAL INSTRUMENTATION 10

Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force torque power, strain, stress, pressure temperature.

UNIT III DATA DISPLAY AND RECORDING DEVICES 8

Data display-CRO, LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

UNIT IV CONTROL 9

Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole and zero of a system, realization of transfer functions.

UNIT V STABILITY ANALYSIS 9

Stability criteria bode plots, routh and Nyquist criteria.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. B.C.Nakra, K.K.choudry, "Instrumentation, Measurement and analysis", Tata McGraw Hill 2002
2. J.J.Nagrath and Gopal, "control system engineering", New age international (p) Ltd., 2000

REFERENCES:

1. C.S.Rangan, G.R.Sarma, VSV Mani, "Instrumentation devices and systems", Tata McGraw Hill, 2000
2. A.K. Sowney, "electrical and electronic measurement and instrumentation", "Dhanpat Rai & Co, 2003.
3. Benjamin C.Kuo, "Automatic control system", prentice hall of India pvt Ltd., 2002
4. Ernest O.Doeblin, "measurement systems applications and design", McGraw Hill International editions, 1990
5. S.Renganathan, "transducer engineering", Allied publishers, 1990.

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 of cleaning process – alkaline cleaning – emulsion cleaning- ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and short 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 COVENSION COATINGS 9

Plating coating – laequers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, zinc, 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**TEXT BOOKS:**

1. STAND 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

UNIT I INTRODUCTION 9

Classification of machining processes, machine tools – machine tool construction – factors – performance criteria – trends in modern machine tool – kinematic arrangement of different types of machine tools – work holding and tool holding devices – calculation of cutting forces and power requirements for turning, milling, boring and grinding – force distribution on different parts of drilling, milling and grinding machine tools.

UNIT II STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES 10

Basic principles of design – comparison of materials used in machine tool construction – dependence of process capability on rigidity – static compliance – design of lathe beds – materials – typical construction – torsional modulus of rectangular and box sections – methods of increasing rigidities.

UNIT III SLIDEWAYS 9

Slide ways – types – materials – constructions – clearance adjustments – Hydrostatically lubricated slide ways – slide way design – pressure distribution – antifriction ways – design – construction.

UNIT IV SPINDLES AND SPINDLE SUPPORTS 8

Spindle units – materials – spindle design – spindle bearings – types of materials – constructions.

UNIT V MACHINE TOOL DYNAMICS 9

Dynamic system – elastic system – working processes – vibration in machine tools – self excited vibration and dynamic stability – basic principles of chatter – effects of vibration – vibration elimination – damping – isolation of vibration – dynamic absorber with damping.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. G.C. Sen and A.Battacharya, "Principles of machine tools", New central book agency, 1999

REFERENCES:

1. Manfred week, "Hand Book of machine tools – vol1, vol 2, vol.3 John Wiley & Sons, 1984.
2. Acherkan.N, "Machine Tool Design", vol 3, MIR publishers, 1978
3. N.K.Metha, "Machine Tool Design and Numerical control", Tata McGraw Hill publishing company, 1996

PTPR9030 PURCHASING AND MATERIALS MANAGEMENT L T P C
3 0 0 3

UNIT I FUNCTIONS OF MATERIALS MANAGEMENT 6
 Introduction to materials management – objectives – Organization – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II PURCHASING MANAGEMENT 8
 Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations - Insurance and claims managements

UNIT III STORES MANAGEMENT 8
 Store function – Location – Layout – Stock taking – Materials handling – codification – Inventory pricing – MIS for stores management

UNIT IV MATERIALS PLANNING 12
 Forecasting - ABC analysis – Materials requirements planning - Inventory systems – Quantity – periodic – Deterministic models – Aggregate planning – JIT.

UNIT V INVENTORY MANAGEMENT 11
 Basic EOQ Model – Discount Model - Finite Production – Lot size under constraints – Application of O.R. Techniques in Materials Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and Cases, Tata McGraw Hill, 1996.

REFERENCES:

1. Gopalakrishnan P.Handbook of Materials Management, Prentice Hall of India, 1996.
2. Guptha P.K. and Manmohan, Problems in Operations Research, Sultan Chand & Sons, 1994
3. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn, Engineering Management, Eswar Press 2005

PTPR9031 NON-DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

AIM:

To impart knowledge on Non Destructive Testing procedures.

OBJECTIVES:

- (1) To understand principle behind various NDT techniques.
- (2) To study about NDT equipments and accessories.
- (3) To learn working procedures of various NDT techniques.

PRE-REQUISITES: Basic knowledge on various process defects

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION 06
 Introduction to various non-destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 10

Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods – Applications
Principle of MPT, Magnetising technical and procedure used for testing a component , Equipment used for MPT , Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING 10

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications
Principle of AET, AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING 10

Principle, Ultrasonic transducers, Inspection Methods – Normal Incident Pulse-echo Inspection, Through - transmission Testing, angle Beam Pulse-echo testing, Techniques for Normal Beam Inspection, Ultrasonic Flaw detection Equipment, Modes of display – A- scan, B-Scan & C- Scan- Applications

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 09

Basic principle, Effect of radiation on Film, Radiographic imaging – Inspection Techniques – Single wall single image, Double wall Penetration & Multiwall Penetration technique – Comparison and selection of various NDT techniques

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Baldev raj, T Jeyakumar, M. Thavasimuthu “Practical Non Destructive Testing” Narosa publishing house, New Delhi, 2002

REFERENCES:

1. Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer – Verlag Publication, New York, 1996.
2. Peter J. Shull “Non Destructive Evaluation: Theory, Techniques and Application” Marcel Dekker, Inc., New York, 2002
3. www.ndt.net
4. Baldev Raj and B.Venkataraman, “Practical Radiology”, Narosa Publishing House, 2004
5. Birchan.B, “Non-Destructive Testing”, Oxford, London, 1975

PTPR9026

PRODUCTION MANAGEMENT

**L T P C
3 0 0 3**

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

General principles of management – management functions – organization – types – comparison – functions of personnel management – recruitment training leadership/motivation – communication – Conflict industrial relations – trade union.

UNIT II INVENTORY MANAGEMENT 11

Purpose of Inventory – Cost related to inventors – Basic EOQ model – variations in EOQ model – Finite Production quality discounts – ABC Analysis – MRP Analysis.

UNIT III OPERATIONS MANAGEMENT 10
 Plant Location – Layout – Materials Handling – Method Study – Time Study –
 Ergonomics – Aggregate Planning – Value Analysis

UNIT IV FINANCIAL MANAGEMENT 10
 Capital – Types – sources – break even analysis – financial statements – income
 statement – balance – balance sheet – capital budgeting – working capital management
 – inventory pricing.

UNIT V MARKETING MANAGEMENT 7
 Functions of marketing – Sales promotion methods – advertising – product packaging –
 marketing variables – distribution channels – organization – market research market
 research techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Kesavan, C.Elanchezian and T.Sundar Selwyn – Engineering management –
 Eswar Press, 2005

REFERENCES:

1. Koont and G'donnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995
3. I.M. Pandey – Financial Management, Vikas Publishing house, 1995
4. K.K.Ahuja – Personal Management, Kalyane Publication 1992
5. K. Panneerselvam – Production and Operations Management – Prentice Hall of
 India, 2003
6. Martand T. Telesand – Industrial and Business management – S.Chand & Co., 2001

PTPR9029 ENGINEERING ECONOMICS & FINANCIAL L T P C
MANAGEMENT 3 0 0 3

UNIT I FINANCIAL ACCOUNTING 13
 Accounting principles – basic records depreciation – depreciation methods – preparation
 and interpretation of profit and loss statement – balance sheet – fixed assets – current
 assets.

UNIT II PROFIT VALUE ANALYSIS 10
 Cost volume profit relationship – relevant costs in decision making profit management
 analysis – break even analysis – margin of safety Angle of incident & multi product break
 even analysis – Effect of changes in volume selling price fixed cost and variable cost on
 profit.

UNIT III WORKING CAPITAL MANAGEMENT 8
 Current assets and liability decisions – estimation of working capital requirements –
 Management of accounts receivable – Inventory – cash – inventory valuation methods.

UNIT IV CAPITAL BUDGETING 8
 Significance of capital budgeting – payback period – present value method – Accounting
 rate of return method.

UNIT V ENGINEERING ECONOMICS 7
 Economics – Engineering economics – Demand analysis Laws of demand – Production and cost – Pricing methods

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Kesavan, C.Elanchezhian 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.

PTPR9037 ADVANCES IN OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVE:

- (i) To introduce the advanced OR models and to apply them for Engineering problems

UNIT I INTRODUCTION 5
 Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT II CLASSIC OPTIMIZATION TECHNIQUES 10
 Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming.

UNIT III NON-LINEAR PROGRAMMING 9
 Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming

UNIT IV INTEGER PROGRAMMING 11
 Cutting plane algorithm – Branch and bound technique - Zero-one implicit enumeration; Goal programming – geometric programming; Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT V DYNAMIC PROGRAMMING 10
 Formulation – Application to capital budgeting, reliability improvement, shortest path, solution of LP using DP.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1 – 2005

REFERENCES:

1. P.K. Gupta and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994
2. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
3. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
4. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Dale H. Besterfield, "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

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

UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES 9

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

UNIT II ADVANCED FUZZY LOGIC APPLICATIONS 9

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization – various

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

UNIT IV OTHER ANN ARCHITECTURES 9

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive resonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohonen self organizing maps – learning vector quantization – counter propagation networks – industrial applications.

UNIT V RECENT ADVANCES 9

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. S.Rajasekaran.G.A.Vijayalakshmi Pai “Neural Networks, fuzzy logic and genetic algorithms”, prentice hall of India private limited, 2003

REFERENCES:

1. Klir.G, Yuan B.B. “Fuzzy sets and fuzzy logic prentice Hall of India private limited, 1997.
2. Timothy J.Ross, “Fuzzy logic with engineering applications”, McGraw Hill, 1995
3. Zurada J.M. “Introduction to artificial neural systems”, Jaico publishing house, 1994
4. Laurance Fausett, “Fundamentals of neural networks”, Prentice hall, 1992
5. Gen, M. and R. Cheng “Genetic algorithm and engineering design”, john wiley 1997

PTPR9034 MACHINE TOOL CONTROL & CONDITION MONITORING L T P C
3 0 0 3

OBJECTIVE:

- (i) To understand the control system of machine tools and its applications
- (ii) To understand the objectives, aims and methodology of machine tool condition monitoring and diagnostics.

UNIT I OVERVIEW OF AUTOMATIC CONTROLS IN MACHINE TOOLS 6

Open loop – closed loop system – block diagram representation of machine tool control systems.

UNIT II COMPUTER CONTROL SYSTEM 15

Process computer-peripherals – Data logger-Direct digital control-Supervisory computer control-Adaptive control-types-adaptive control for turning, milling, grinding and EDM-Programmable logic controller-Functions-applications in machine tools.

UNIT III DRIVE SYSTEMS IN MACHINE TOOLS 8

Electrical, hydraulic and pneumatic types – servo motor-stepper motor-ball screw mechanism. Feed back devices-Syncro, resolver, diffraction gratings, potentiometer, and inductosyn-encoders-application in machine tools.

UNIT IV CONDITION MONITORING 8

Condition monitoring techniques – Visual, temperature, vibration, lubricant, thickness, noise and sound. Condition monitoring of machine tools.

UNIT V MACHINE TOOL DIAGNOSTICS 8

Objectives-aims-examples of monitoring and diagnosis-control structures for machine diagnosis-utilization of diagnostic results.

TOTAL: 45 PERIODS

REFERENCES:

1. Manfred weck, “Hand book of machine tools – Vol.3, John Wiley & Sons, 1984.
2. Sushil Kumar Srivstava “ industrial maintenance management” S.Chand & company Ltd., New Delhi, 1998.
3. Mikell P.Groover, “Automation Production system and Computer Integrated Manufacturing”, Prentice Hall of India, Pvt.Ltd., 1995.

PTPR 9038 MODERN MANUFACTURING PROCESS L T P C
3 0 0 3

UNIT I MECHANICAL AND ENERGY BASED PROCESSES 8

Abrasive Jet Machining – Water Jet machining – Ultrasonic machining, (AJM, WJM and USM). Working Principles – equipment used – Processes parameters – MRR – Variation in techniques used – Applications.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 10

Chemical machining and Electro-Chemical machining (CHM and ECM) – Etchants – maskant-techniques of applying maskants – Process Parameters – MRR – Applications. Principles of ECM – equipments – MRR – Electrical circuit – Process Parameters – ECG and ECH Applications..

UNIT III ELECTRICAL ENERGY BASED WASTE PROCESSES 8
Electric Discharge Machining (EDM) – working principles – equipments – Process Parameters – MRR – Electrode-Tool – Power circuits-Tool Wear – Dielectric – Flushing – Wire cut – EDM – Applications.

UNIT IV THERMAL ENERGY PROCESS 10
Laser Beam machining (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM), Principles – Equipment – Types – Beam control techniques – Applications.

UNIT V RAPID PROTOTYPING AND RAPID TOOLING 9
Introduction-Stereo Lithography-Fused Deposition Moulding-Selective Laser Sintering-Laminated Object Manufacturing-Solid Base Curing-Direct Manufacturing and Rapid Tooling.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Serope Kalpakjian, Stevan R.Schemid, "Manufacturing Processes for Engineering Materials", Fourth edition, Pearson Education, 2003.
2. Vijay K.Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd.,New Delhi (2002) ISBN 87-7764-294-4

REFERENCES:

1. Serope Kalpakjian, "Manufacturing Engineering and Technology", Third Edition-Addison-Wesley Publication, Co, 1995.
2. Brahem, T.Smith, "Advanced machining", I.F.,S., U.K. 1989
3. Amstead B.H., Ostwald Phylips and bageman, R.L., "Manufacturing Processes", John Wileys Songs 1987.
4. Benediet, G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).
5. Pandey P.C. and Shan H.S., "Modern Machining Processes" Tata McGraw Hill, New Delhi (1980).

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

UNIT I INTRODUCTION 10
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS 10
Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5
Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 10

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

UNIT V CHARECTERISATION TECHNIQUES 10

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

**PTPR9028 PROCESSING OF POLYMER AND COMPOSITES L T P C
3 0 0 3**

UNIT I INTRODUCTION 8

Classification of polymers – properties and applications of selective engineering polymers – fundamentals of composites – need for composites – enhancement of properties – classification of composites – matrix polymer matrix composites (PMC), metal matrix composites (MMC), Ceramic matrix composites (CMC) reinforcement – particle reinforced composites, fibre reinforced composites, applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES 12

Polymer matrix resins – thermosetting resins, thermoplastic resins – reinforcement fibres – rovings – woven fabrics – non woven random mats – various types of fibres, PMC processes – hand lay up processes – spray lay up processes – compression moulding – reinforced reaction injection moulding – resin transfer moulding – poltrusion – filament winding – injection moulding fibre reinforced plastics (FRP) (Glass fibre reinforced plastics (GRP).

UNIT III METAL MATRIX COMPOSITES 9

Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC limitations of MMC – Metal matrix – reinforcements – particles – fibres. Effect of reinforcement – volume fraction – Rule of mixtures, processing of MMC – Powder metallurgy process diffusion bonding – stir casting squeeze casting.

UNIT IV CERAMICS MATRIX COMPOSITES 9

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics – Need for CMC – Ceramic matrix – various types of ceramic matrix composites – oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride –

reinforcements – particles – fibres – whiskers. Sintering- Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V ADVANCES IN POLYMERS & COMPOSITES 7

Carbon/carbon composites – advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Solgel technique. Composites for aerospace industrial applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mathews F.L. and Rawings R.D., “Composite materials, Engineering and Science”, Chapman.
2. Chawla K.K. “Composite Materails”, Springer Verlag, 1987
3. Kenneth G.Budinski & Michael K. Budinski, “Engineering Materials”, Prentice Hall of India pvt ltd., 4th Indian reprint, 2002

REFERENCES:

1. T.W.Clync and P.J. Withers, “Introduction to Metal Matrix Composites”. Cambridge University Press, 1993.
2. B.Strong, “Fundamentals of composite manufacturing, SME, 1989
3. S.C.Sharma, “Composite materials”, Narosa publications, 2000
4. “Short term course on advances in composite materials”, “composite technology centre, department of metallurgy, iit – madras, December 2001.
5. Brydson, Hand book of plastic processing
6. Weatherhead R.G. “FRP technology” (Fibre Reinforced Resin System), Applied Science Publishers Limited, London, 1990.

PTPR9403

MECHATRONICS SYSTEMS

**L T P C
3 0 0 3**

OBJECTIVES:

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

UNIT I INTRODUCTION 7

Introduction to Mechatronics-systems – Mechatronics approach to modern engineering and design – Need of Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics – Mechatronics elements.

UNIT II SENSORS AND TRANSDUCERS 12

Introduction – Performance Terminology – Potentiometers – Strain gauges – I VDT – Eddy current sensor – Hall effect sensor – Capacitance sensors – Digital transducers – Temperature sensors – Optical sensors – Piezo electric sensor-ultrasonic sensors – Proximity sensors – Signal processing techniques.

UNIT III MICROPROCESSORS AND MICROCONTROLLERS 12

Introduction – Architectures of 8 – bitmicrocontrollers (8051) series, PIC Microcontrollers (16f xxx) series – Assembly language programming instruction format, addressing modes, instruction sets, Basic program examples interface of keypads, leds, leds, A/D and D/A Converters, RS 232 serial communication interface, classification of memories.

UNIT IV ACTUATORS 8
Switching Devices, Classification of actuators – Electrical actuators – Solid state relays, solenoids, D.C. motors, Servo motors, Stepper motors – Interfacing with microcontroller through H-bridge Circuits – Piezoelectric actuators.

UNIT V MECHATRONIC SYSTEMS 6
Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies – Engine management system, Automatic camera, Automatic washing machine, Pick and place robots.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. W.Bolton, "MECHATRONICS" Pearson Education Limited, 2004.

REFERENCES:

1. R.K.Rajput.A Text Book of Mechatronics, Chand &Co, 2007
2. M.A. Mazidi & J.G. Mazidi, 8051 Microcontroller and embedded systems, 2002
3. Devadas shetty, Richard A. Kolk, "Mechatronics System Design", PWS Publishing Company, 2001.

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

UNIT I ENGINEERING ETHICS 9
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 9
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTGE9261**ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C****3 0 0 3****AIM:**

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

OBJECTIVE:

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**14**

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

Field study of common plants, insects, birds

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

UNIT II ENVIRONMENTAL POLLUTION 8

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

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

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES

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