ANNA UNIVERSITY :: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

CURRICULUM – R 2008

B.E. PRODUCTION ENGINEERING

CURRICULUM FROM III TO VIII SEMESTERS FOR B.E. PRODUCTION ENGINEERING

SEMESTER – III

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA9211	Mathematics III	3	1	0	4
AE9201	Engineering Fluid Mechanics	3	1	0	4
AU9201	Thermodynamics and Thermal Engineering	3	1	0	4
AU9202	Solid Mechanics	3	1	0	4
EI9211	Electronics and Instrumentation	3	0	0	3
PR9201	Engineering Metallurgy	3	0	0	3
PRACTICAL					
PR9202	Computer Aided Machines & Part Drawing	0	0	3	2
PR9203	Mechanical Sciences Laboratory	0	0	3	2
	TOTAL	**18**	**4**	**6**	**26**

SEMESTER – IV

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA9262	Numerical Methods	3	1	0	4
PR9251	Theory of Machines	3	1	0	4
PR9252	Fluid Power Drives & Control	3	0	0	3
PR9253	Foundry & Welding Technology	3	0	0	3
PR9254	Advanced Machining Processes	3	0	0	3
PR9255	Metal Forming Processes	3	0	0	3
PRACTICAL					
PR9256	Metallurgy Lab	0	0	3	2
PR9257	Fluid Power Lab	0	0	3	2
EI9261	Electrical and Electronics Engineering Lab	0	0	3	2
	TOTAL	**18**	**2**	**9**	**26**

SEMESTER – V

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PR9301	Engineering Statistics and Quality Control	3	1	0	4
PR9302	Metrology & Computer Aided Inspection	3	0	0	3
PR9303	Machine Design	3	1	0	4
PR9304	Quantitative Techniques in Management	3	1	0	4
PR9305	Production of Automotive Components	3	0	0	3
	Elective I	3	0	0	3
PRACTICAL					
PR9306	Computer Aided Design Lab	0	0	3	2
PR9307	Metal Forming Lab and Special Machines Lab	0	0	3	2
PR9308	Technical Seminar	0	0	2	1
	TOTAL	**18**	**3**	**8**	**26**

SEMESTER – VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PR9351	Finite Element Analysis in Manufacturing Engineering	3	0	0	3
PR9352	Computer Aided Product Design	3	0	0	3
PR9353	Design of Jigs, Fixture, Press Tools & Drawing	3	1	0	4
PR9354	Automated production & computer integrated Manufacturing	3	0	0	3
	Elective II	3	0	0	3
	Elective III	3	0	0	3
PRACTICAL					
PR9355	CNC Laboratory	0	0	3	2
PR9356	Advanced CAD Laboratory	0	0	3	2
PR9357	Metrology & Inspection Laboratory	0	0	3	2
GE9371	Communication Skill and soft skills Laboratory	0	0	2	1
	TOTAL	**18**	**1**	**11**	**26**

SEMESTER – VII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PR9401	Manufacturing Processes Planning & Cost Estimation	3	0	0	3
PR9402	Engineering Management	3	0	0	3
PR9403	Mechatronics Systems	3	0	0	3
PR9404	Industrial Robotics	3	0	0	3
	Elective IV	3	0	0	3
PRACTICAL					
PR9405	Design and Fabrication Project	0	0	4	2
PR9406	Industrial Training	0	0	2	1
PR9407	Mechatronics & Robotics Laboratory	0	0	3	2
PR9408	Comprehension	0	0	2	1
	TOTAL	**15**	**0**	**11**	**21**

SEMESTER – VIII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
	Elective – V	3	0	0	3
	Elective – VI	3	0	0	3
PRACTICAL					
PR9451	Project Work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

TOTAL CREDIT: 191

LIST OF ELECTIVES FOR B.E. PRODUCTION ENGINEERING

ELECTIVES – I

CODE NO.	COURSE TITLE	L	T	P	C
PR9021	Precision Engineering	3	0	0	3
PR9022	Fuzzy Logic & Neutral Networks	3	0	0	3
PR9023	Instrumentation & Control	3	0	0	3
PR9024	Surface Engineering	3	0	0	3
PR9025	Design of Machine Tool Structure	3	0	0	3
PR9026	Production Management	3	0	0	3
PR9027	Ergonomics	3	0	0	3
PR9028	Processing of Polymer & Composites	3	0	0	3
PR9029	Engg Economics & Financial Management	3	0	0	3
PR9030	Purchasing & Material Management	3	0	0	3
PR9031	Non Destructive Testing Methods	3	0	0	3
PR9032	Simulation of manufacturing system	3	0	0	3
PR9033	Reliability Engineering	3	0	0	3
PR9034	Machine Tool Control & Condition Monitoring	3	0	0	3
PR9035	Mini Project	0	0	6	3
PR9036	Machine Vision	3	0	0	3
PR9037	Advances in Operation Research	3	0	0	3
PR9038	Modern Manufacturing Processes	3	0	0	3
PT9071	Packaging Materials and Technology	3	0	0	3
GE9021	Professional Ethics in Engineering	3	0	0	3
GE9022	Total Quality Management	3	0	0	3
GE9023	Fundamentals of Nanoscience	3	0	0	3

MA9211 **MATHEMATICS III** **L T P C**
3 1 0 4

AIM

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

OBJECTIVES

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

UNIT I FOURIER SERIES 9+3

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

UNIT II FOURIER TRANSFORM 9+3

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

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9+3

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

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

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

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9+3

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

L: 45, T: 15, TOTAL: 60 PERIODS

TEXT BOOK

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

REFERENCES

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

AE9201 ENGINEERING FLUID MECHANICS L T P C
3 1 0 4

UNIT I BASIC CONCEPTS 15

Introduction – Fluid properties – Newton's viscosity law – Classification of fluids and fluid motion – Fluid statics – Hydrostatic force on submerged surfaces – stability of floating bodies – Dimensional analysis – The Buckingham-Pi theorem – Significant dimensionless groups – Flow similarity and model studies

UNIT II BASIC EQUATIONS OF FLUID FLOW ANALYSIS 15

Basic laws for a system in integral form – Conservation of mass – Newton's 2nd law – Laws of thermodynamics – Application of the basic laws for a control volume – Kinematics – Motion of a fluid particle – Fluid deformation – Differential analysis of fluid motion – Continuity equation – Differential momentum equation – The Navier Stokes equations

UNIT III INCOMPRESSIBLE INVISCID FLOW 8

Euler's equations of motion – Bernoulli's equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows

UNIT IV INCOMPRESSIBLE VISCOUS FLOW 8

Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines – Moody's diagram

UNIT V FLUID MACHINERY 14

Introduction and classification of fluid machines – Turbo machinery analysis – The angular momentum principle – Euler turbo machine equation – Velocity triangles – Application to fluid systems – Working principle of turbines, fans, blowers, pumps and compressors.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Shames I H, 'Mechanics of Fluids', Kogakusha, Tokyo, 1998
2. Robert W Fox & Alan T Mc.Donald, 'Introduction to fluid Mechanics', John Wiley and Sons, 1995

REFERENCES

1. Yuan S W, 'Foundations of fluid Mechanics', Prentice-Hall, 1987
2. Milne Thompson L M, 'Theoretical Hydrodynamics', MacMillan, 1985
3. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007

AU9201 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 1 0 4

OBJECTIVE

- To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT I BASIC THERMODYNAMICS 16

Systems, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement - Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Properties of gases and vapours.

UNIT II AIR CYCLE AND COMPRESSORS 12

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency . Mean effective pressure, Reciprocating compressors.

UNIT III STEAM AND JET PROPULSION 12

Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 10

Principles of Psychrometry and refrigeration - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.

UNIT V HEAT TRANSFER 10

Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer – Flow through heat exchangers.

TOTAL: 60 PERIODS

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

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.

REFERENCES

1. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

AU9202	SOLID MECHANICS	L T P C
		3 1 0 4

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.

EI9211 ELECTRONICS AND INSTRUMENTATION L T P C
3 0 0 3

UNIT I ELECTRONIC COMPONENTS AND DEVICES 10

Resistors, Capacitors, Inductors and Transformers - properties, types. Simple PN Junction Diodes, Zener diode, Bipolar Junction transistor and Field Effect Transistors – operating principles and characteristics. Other Devices – UJT, SCR, LED, Photodetectors.

UNIT II ANALOG CIRCUITS 10

Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) – properties and typical circuits like differentiator, integrator, summer, comparator, single-stage BJT's and FET's amplifiers – Multistage Amplifier Principles(Qualitative Treatment only).

UNIT III DIGITAL CIRCUITS 10

Basics of Boolean Logic – Logic Gates, Flip-Flops, Shift-Registers, Counters, Decoders/Drivers, Timer, Display Devices, A/D and D/A Converters.

UNIT IV MEASUREMENTS AND INSTRUMENTS 7

Definitions of Accuracy, Precision, Sensitivity, Resolution, Linearity, Range, Measurement of Electrical Quantities – Voltmeter, Ammeter, Watt-Meter, DMM, CRO, DSO, Transducers and signal conditioning systems for pressure, temperature, acceleration measurements (Qualitative Treatment only).

UNIT V MICROPROCESSORS AND APPLICATIONS 8

Architecture of 8085 processors, Address Modes, Instruction set, simple programming like addition, subtraction, multiplication, logical operation, Peripherals and Interfacing – 8255, 8251. Applications like motor control, keyboard and PC interface, Introduction to Microcontrollers.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Millman.J. and Halkias.C., "Integrated Electronics", Tata McGraw Hill, 2004.
2. Paul Horowitz and Wilfred Hill "The Art of Electronics", Cambridge University press,1989.

REFERENCES

1. Donald P Leach, Albert Paul Malvino and Goutam Saha," Digital Principles & Applications",6E, Tata McGraw Hill, 2006.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Raj. and Sons, New Delhi, 1999
3. Helfrick.A.D., and Cooper.W.D., '"Electronic Instrumentation and Measurement techniques", Prentice Hall of India, 1998.
4. Gaonkar. Ramesh S, " Microprocessor Architecture Programming and Applications with 8085", 5th Ed. Penram International Publishing (India). 2003 .
5. Kenneth J.Ayala., "The 8051 Microcontroller Architecture Programming and Applications", 2ed, Penram International Publishing (India).2004.

PR9201 ENGINEERING METALLURGY L T P C
3 0 0 3

OBJECTIVE:

- To introduce the various concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals
- 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, planner 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 – Carbide & 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 AI-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.

PR9202 COMPUTER AIDED MACHINES AND PART DRAWING L T P C
0 0 3 2

OBJECTIVE:

- To train the students in construction of machine elements and assembly Drawing Train the students to allocate geometrical tolerances and to develop part drawing

1. Instruction to machine drawing & production drawing classification of drawing-BIS conventions – Orthographic and sectional views. Reviews of the concepts of limits, tolerance, fits, surface roughness, and symbols terminology used in Production drawing.

2. Machine element joints – Types of joints – Screw fasteners – Pin joints, couplings welded joints.

3. Computer Aided Production Drafting Detailed part drawing and assembly drawings (with suitable tolerances, machine symbols, specification of fit).
   1) Screw jack
   2) Shaper tool head
   3) Non return valve
   4) Plummer block
   5) Foot step drawing
   6) Machine vice
   7) Four jaw chuck of lathe
   8) Lathe tail stock
   9) Square tool post
   10) Universal coupling
   11) Hydraulic & Pneumatic Assembly

TOTAL: 45 PERIODS

TEXT BOOK:

1. Narayana K.L., Kannaiah P and Venkata Reddy – “Production Drawing” New age International Limited, Delhi 2004.

REFERENCES:

1. Bhat N.D., “Machine Drawing”, Charotar Publishing House, Anand 2000
2. Nagtal G.R., “Machine Drawing”, Khanna Publishers, New Delhi 1994.
3. Sache Singh & P.L. Shah – Fundamentals of Machine Drawing, Prentice Hall India, 2003.

PR9203 MECHANICAL SCIENCES LABORATORY L T P C
0 0 3 2

OBJECTIVE:

- To train the students in testing and quantifying the mechanical properties of Engineering Materials, Engines and Heat Exchangers

LIST OF EXPERIMENTS

1. Tension Test
2. Torsion Test
3. Testing of springs
4. Impact test i) Izod, ii) Charpy
5. Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
6. Deflection of Beams
7. Dye Penetrant Test
8. Performance test on a 4 storke engine
9. Viscosity determination of the given fluid
10. Moment of inertial of connecting rod
11. Determination of Effectiveness of a parallel and counter flow heat exchangers
12. Valve timing of a 4 stroke engine and port timing of a 2 stroke engine

TOTAL: 45 PERIODS

MA9262 NUMERICAL METHODS L T P C
3 1 0 4

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 13

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

UNIT II INTERPOLATION AND APPROXIMATION 11

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 DIFFERENTATION AND INTEGRATION 12

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 12

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 12

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.

PR9251 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 – 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 Dukkipati 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.
5. Burton Paul "Kinematics and Dynamics of Machinery", Prentice Hall, 1979.

PR9252 FLUID POWER DRIVES AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To understand the working principle of hydraulic and pneumatic components and its selection
- 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. Peter Rohner, "Fluid Power Logic circuit, Design", Macmillon Press Ltd., 1990.
3. Andrew Parr "Hydraulics & Pneumatics", Jaico Publishing House, 2004

PR9253 FOUNDRY & 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 ES 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 – positions 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 – CO_2 moulding – Plaster mould castings – Antioch process – Slush casting.

UNIT IV SPECIAL WELDING PROCESSES 9

Atomic H_2 arc welding – Shielded metal 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, case – studies in testing of joints & castings.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Principle of Foundry Technology – P.L.Jain, Tata McGraw Hill – 2003
2. Welding Engineering & Technology R.S.Parmer – Khanna Publishers – 2002.
3. Principle of metal casting – Heine, Looper and Rosenthal – Tata McGraw Hill – 2001

REFERENCES

1. Modern Welding Technology – B.Curry – Prentice Hall – 2002
2. Welding Principle & applications – Larry Jeff in Delmar – 1997
3. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 93

PR9254 ADVANCED MACHINING PROCESSES L T P C
3 0 0 3

0BJECTIVES:

- To understand the theory of metal cutting
- To understand the concepts of gear manufacture
- 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 hobbing 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”, - El.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

PR9255 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 – Mannesmann process of seamless tube 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 BOOK

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

PR9256 **METALLURGY LABORATORY** **L T P C**
0 0 3 2

OBJECTIVE:

- To train the students in observation and interpretation of Microstructure of Engineering materials.
- To train students in Heat treatment, harden ability and surface treatment of Engineering Materials
- 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 (High, Medium, and Low)
   b) Cast Iron (Gray, White, Nodular, Malleable)
   c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
3. Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.
4. Cooling curves
   a) Pure Metal (Pb or Sn)
   b) Alloy (Pb-Sn or Pb-Sb)
5. 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
6. Jominy End Quench Test
7. 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
8. Electro-chemical Test
   a) Electro deposition
   b) Electro-chemical etching test

TOTAL: 45 PERIODS

PR9257	FLUID POWER LABORATORY	L T P C 0 0 3 2

OBJECTIVES:

- To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
- 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 values
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

EI9261 ELECTRICAL AND ELECTRONICS ENGINEERING LAB

L	T	P	C
0	0	3	2

1. Load test on separately excited DC shunt generator
2. Load test on DC shunt moor
3. Load test on Sϕ Transformer
4. Load test on Induction motor
5. Regulation of 3ϕ Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and thermistor
13. Flapper Nozzle

TOTAL: 45 PERIODS

PR9301 ENGINEERING STATISTICS AND QUALITY CONTROL L T P C
3 1 0 4

UNIT I SAMPLING THEORY AND TESTING OF HYPOTHESIS 12

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

UNIT II STATISTICAL PROCESS CONTROL 12

Variation in process – Factors – control charts – variables $\overline{X}$ - R and $\overline{X}$ - σ, Run chart, Control chart for Attributes P,C and U-Chart, Demerit chart, Establishing and interpreting control charts – process capability – Quality rating – Short run SPC.

UNIT III ACCEPTANCE SAMPLING 12

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 – standard sampling plans for AQL and LTPD – use of standard sampling plans.

UNIT IV RELIABILITY AND QUALITY 12

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

UNIT V EXPERIMENTAL DESIGN AND TAGUCHI METHOD 12

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 BOOK

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

REFERENCES

1. Bester field D.H., "Quality Control" Prentice Hall, 1993.
2. Manohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
3. Sharma .S.C. "Inspection Quality Control and Reliability", Khanna Publication, 1998.

PR9302 METROLOGY AND COMPUTER AIDED INSPECTION L T P C
3 0 0 3

OBJECTIVE

- To understand the concept of Metrology
- To learn about Metrology instruments and application for various measurements
- To introduce concept of computer application in Metrology.

UNIT I GENERAL CONCEPTS OF MEASUREMENT 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 comparator - Angular measuring instruments- Angle gauges - sine bar, - precision spirit level, Autocollimators, 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 Telescope - metroscope.

UNIT IV METROLOGY OF SCREW THREADS AND GEARS 9

Internal & External screw threads - 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 AND LASER METROLOGY 9

Co-ordinate measuring machine – Probe sensors – errors – environmental factors – Laser micrometer – Laser interferometer – Testing straightness and angle measurement using laser interferometer – 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 BOOK

1. GUPTA. I.C. “A Text Book of Engineering metrology”, Dhanpat Rai and sons, 1996.

REFERENCES

1. R.K. JAIN. “Engineering Metrology”, Khanna publishers. 2002
2. G.N.GALYER F.W. and C.R.SHOTBOLT, “Metrology for Engineers”, ELBS, 1990
3. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992
4. R.K. RAJPUT. “Engineering Metrology and Instrumentation”, Kataria &Sons Publishers, 2001

PR9303 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 12

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 12

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 12

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 12

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

UNIT V SPRINGS AND BEARINGS 12

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

TEXT BOOK

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.

PR9305 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

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

OBJECTIVE:
To impart knowledge in various manufacturing methods in developing automotive components and To study the principle of automobile engineering

UNIT I ENGINE 9
Working principle of two stroke, four stroke and wankel engines – wet and dry liners – Piston and Piston rings – types – classification.
Production and testing of – Cylinder block, Cylinder head, liners, oil pan, piston and piston rings.

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 BOOK
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.

PR9304 QUANTITATIVE TECHNIQUES IN MANAGEMENT LT P C
3 1 0 4

UNIT I LINEAR PROGRAMMING 16

Problem formulation Graphical method – simplex method – transportation and assignment method – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY 11

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 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, SEQUENCING AND PROJECT NET WORK ANALYSIS 16

Purpose of forecasting – methods of forecasting – sequencing – methods of sequencing – line balancing – project network analysis – CPM – PERT – time crashing – applications.

UNIT V ADVANCED TOPICS 8

Dynamic programming - Integer Programming – Decision Tree Analysis.

TOTAL: 60 PERIODS

TEXT BOOK

1. K.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, 1002.
3. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992.
4. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997.
5. Handy A.Taha, Operations Research – An Introduction, Prentice Hall of India, 1997.

PR9306 COMPUTER AIDED DESIGN LAB L T P C
0 0 3 2

OBJECTIVE

- To train the student in 2D and 3D modeling using popular and high end software packages.
- To enable the student to understand the distinguishing features of 2 or 3 CAD packages.

LIST OF EXPERIMENTS

1. Two dimensional geometry creation and modification using standard drafting package.
2. Detailing and documentation of a typical production drawing.
3. Attributes and Data extraction from a drawing
4. Creation of Simple Solid Models using CSG and B-Rep Approach.
5. Surface Modeling types.
6. Interfacing database package with typical drafting package.
7. Object Modeling and Mesh generation using simple elements.
8. Analysis of typical machine elements.
9. Kinematics Analysis of simple mechanisms.
10. Software project consisting of development of algorithms and programs in the field of manufacturing applications.
11. Comparative Study of the features of at least three high-end Cad Software packages.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS

(for the batch of 30 students)

1. Computer System
   (Pentium 4, 256 RAM, 40 GB HDD, 17 inch Color Monitor) 30 Sets.

2. Auto CAD 2004 or Pro-E or CATIA or Unigraphics 15 Licenses.

PR9307 METAL FORMING AND SPECIAL MACHINES LABARATORY L T P C
0 0 3 2

METAL FORMING LAB

1. Construction Flow Stress – Strain curve
2. Erichsen cupping Test
3. Determination of interface friction factor using ring compression test
4. Construction of FLD of sheet metal
5. Water hammer forming

6. Determination of Power consumption in sheet rolling process
7. Determination of strain rate sensitivity index of given specimen
8. Superplastic forming studies on Pb-Sn alloys
9. Deep drawing
10. Forward Extrusion process
11. Micro-forming
12. Simulation studies on metal forming

SPECIAL MACHINE LABORATORY

LIST OF EXPERIMENTS

1. Gear Hobbing
    a. Spur Gear
    b. Helical Gear
2. Planning Machine
    a. V-Block
    b. Dove Tail
3. Centreless Cylindrical Grinding
4. Milling Machine
    a. Spur Gear
5. Tool and Cutter Grinding
6. Tool Wear Studies
7. Acceptance test of machine tool as per isi test chart
8. EDM
9. Capstan and turret lathe
10. Measurement of cutting force

TOTAL: 45 PERIODS

PR9308	**TECHNICAL SEMINAR (Common to all Branches)**	**L T P C 0 0 2 1**

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

PR9351 FINITE ELEMENT APPLICATION IN MANUFACTURING ENGINEERING **L T P C 3 0 0 3**

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-Convergences 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 element-One dimensional heat transfer-Two dimensional finite element analysis-approximation of geometry and field variables-Three nodded triangular element-Four nodded rectangular element-Six nodded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions – concept of non-linearity.

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 crank shaft torsional vibrations-Axi-symmetric FEA of a pressure vessel-Application of FEM in various metal forming processes-Metal cutting machines-Solidification of castings-Weldment design.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Chandrupatla 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. Segerland L.J., “Applied Finite Element Analysis”, John Wiley and Sons, Inc, 1989
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.

PR9352 COMPUTER AIDED PRODUCT DESIGN L T P C

3 0 0 3

UNIT I INTRODUCTION TO COMPUTER AIDED DESIGN 9

Introduction to Engineering Design – Various phases of systematic Design – Sequential Engineering and Concurrent Engineering – introduction to various CAD tools in design process – Computer hardware- software – Graphic workstations – Peripherals – Frameworks and Architectures – Distributed Computing – Workgroup computing – Generic Concurrent Engineering Environment.

UNIT II COMPUTER GRAPHICS FUNDAMENTALS 9

Principles of Interactive computer graphics – Display devices – Interactive devices – Mathematical Elements in computer graphics – 2D, 3D Transformations – Projections – Plane curves – space curves – Surface description and Generation – Bezier, B-Spline and NURBS – Procedure Elements of Computer Graphics – Clipping – Hidden line Elimination – Visual realization concepts.

UNIT III GEOMETRIC MODELLING 9

Geometric Modeling – Types – Wire frame, Surface and Solid Modeling – Mathematical Representation of Solids – Boundary Representation, Constructive Solids Geometry, Sweep representation, Analytic solid modelers – Design data base – Graphics standards – STEP standards – Assembly modeling – use of commercial software packages.

UNIT IV PRODUCT DESIGN CONCEPTS 9

Product modeling – Definition of concepts – Types of product models – types of process chains – Industrial demands – Product Development Process Tools – TRIZ – Genrich Altshuller’s Inventive Principles – Modeling of Product metrics – Various Analysis Tools – Design for Reliability – Design for Manufacturability – machining – casting, welding and metal forming – Principles of optimum design – Design for assembly and disassembly – Probabilistic design concepts – FMEA – QFD – Taguchi method of DOE – Types of Quality loss Functions – Design for product life cycle.

UNIT V RECENT ADVANCES 9

Product Data Management – Concepts – Collaborative Product Design and Commerce – Information Acquisition – Sourcing factor – manufacturing Planning Factor – Customization Factor – Product Life Cycle Management – Applications of AI in product development process.

TOTAL: 45PERIODS

TEXT BOOK

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

REFERENCES

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

PR9353 DESIGN OF JIGS, FIXTRUES AND PRESS TOOLS LT P C
3 1 0 4

UNIT I PURPOSE, TYPES AND FUNCTIONS OF JIGS AND FIXTURES 12

Tool design objectives – production devices – Inspection devices – Materials used in Jigs and fixtures – Types of Jigs – Types of Fixtures – Mechanical actuation – pneumatic and hydraulic actuation – analysis of clamping force – Tolerance and error analysis.

UNIT II JIGS 12

Drill bushes – different types of jigs – plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

UNIT III FIXTURES 12

General principles of boring, lathe, milling and broaching fixtures-Grinding, planning and shaping fixtures, assembly, inspection and welding fixtures – Modular fixtures. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAYOUT 12

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate – punch holder-guide pins and bushes – strippers – knockouts-stops – pilots – Selection of standard die sets strip layout-strip lay out calculations.

UNIT V DESIGN AND DEVELOPMENT OF DIES 12

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies – Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Edward G.Hoffman, Jigs & Fixture Design, Thomson – Delmar Learning, Singapore 2004.
2. Donaldson .C, Tool Design, Tata McGraw – Hill, 1986.

REFERENCES

1. Kempster, "Jigs & Fixtures Design, The English Language Book Society", 1978.
2. Joshi, P.H., "Jigs & Fixtures, Second Edtion", Tata McGraw Hill Publishing Co.Ltd., New Delhi 2004.
3. Hiram E.Grant, "Jigs and Fixture" Tata McGraw Hill, New Delhi, 2003.
4. PSG College of Technology, Coimbatore, Design Data Hand Book.
5. ASME Hand Book.

PR9354 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:

- To understand the various automated manufacturing activities
- To study the application of computer Technology in the manufacturing activities
- 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 BOOK

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.Retrg 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.

PR9355 **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

PR9356 **ADVANCED CAD LABORATORY** **L T P C**
0 0 3 2

OBJECTIVE:
To make use of various cad packages for designing, drafting and analysis of various engineering components

LIST OF EXPERIMENTS

1. 3 D Modeling and assembly of typical industrial components like Pump Impeller using Solid Works and CATIA
2. Finite Element Modelling
   a. Analysis of typical Automotive Components using ANSYS and ABAQUS
3. Simulation study on Superplastic Forming using ABAQUS
4. Assembly of typical parts using CATIA

TOTAL: 45 PERIODS

PR9357 **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 using different instruments

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

GE9371 COMMUNICATION SKILLS AND SOFT SKILLS LABORATORY L T P C
0 0 2 1

AIM:
To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel in their profession.

OBJECTIVES:
- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their jobs.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

A. Viewing and discussing audio-visual materials 6

1. Resume / Report Preparation / Letter Writing: (2)

Letter writing – Job application with Resume - Project report - Email etiquette.

2. Presentation skills: (1)

Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (1)

Time management – Stress management – Assertiveness – Negotiation strategies.

4. Group Discussion: (1)

Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

5. Interview Skills: (1)

Kinds of interviews – Interview techniques – Corporate culture – Mock interviews. (Career Lab Software may be used for this section).

Note: Career Lab software may be used to learn the skills, to be applied in the practice session.

B. Practice session (24 PERIODS)

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. **(4)**
2. **Presentation Skills:** Students make presentations on given topics**.** **(8)**
3. **Group Discussion**: Students participate in group discussions. **(6)**
4. **Interview Skills**: Students participate in Mock Interviews **(6)**

REFERENCES:

1. Anderson, P.V, Technical Communication, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi 2004.
4. David Evans, Decisionmaker, Cambridge University Press, 1997.
5. Thorpe, E and Thorpe, S Objective English, Pearson Education, Second Edition, New Delhi 2007.
6. Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addision Wesley Longman Ltd., Indian reprint 1998.

PR9401 MANUFACTURING PROCESS PLANNING AND COST ESTIMATION **L T P C 3 0 0 3**

AIM:
To evaluate a product in monetary units

OBJECTIVES:
- To develop a good process planner
- 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 PRECIATION **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: 45 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.

PR9402 ENGINEERING MANAGEMENT L T P C
3 0 0 3

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 Odonnel-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.Elanchezian and B.Vijayaramnath – Production Planning and Control, Anuratha Publishing Co. Ltd., Chennai - 2008

PR9403 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 5

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-ultrosonic sensors – Proximity sensors – Signal processing techniques.

UNIT III MICROPROCESSORS AND MICROCONTROLLERS 12

Introduction – Architectures of 8 – bit microcontrollers (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 8

Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies – Engine management system, Automatic camera, Automatic wishing machine, Pick and place robots.

TOTAL: 45 PERIODS

TEXT BOOKS

1. W.Bolton, "MICHATRONICS" 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 Micrcontroller and embedded systems, 2002
3. Devadas shetty, Richard A. Kolk, "Mechatronics System Design", PWS Publishing Company, 2001.

PR9404 INDUSTRIAL ROBOTICS L T 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 programes.

UNIT V APPLICATIONS OF ROBOT 8

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

TOTAL: 45 PERIODS

TEXT BOOK

1. Groover. 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.

PR9405 DESIGN AND FABRICATION PROJECT L T P C
0 0 4 2

The main objective is to give the student hands on training in the fabrication of one or more component of a complete working model, which has been designed by them. The students may be grouped into small groups and work under a project supervisor. The components to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group, which will be evaluated by a Committee which will be constituted by the Head of the Department.

TOTAL: 60 PERIODS

PR9406 **INDUSTRIAL TRAINING** **LT P C**
0 0 2 1

1. The students have to undergo practical industrial training for six weeks in recognized industrial establishments.
2. At the end of the training they have to submit a report with following information:
   i) Profile of the industry
   ii) Product range
   iii) Organization structure
   iv) Plant layout
   v) Processes/Machines/Equipments/Devices
   vi) Personnel welfare schemes
   vii) Details of the training undergone
   viii) Projects undertaken during the training, if any
   ix) Learning points
3. The assessments will be based equally on the report in the prescribed format and viva-voce examination by a committee nominated by the Head of the Department.

TOTAL: 30 PERIODS

PR9407 MECHATRONICS AND ROBOTICS LABORATORY LT P C
0 0 3 2

LIST OF EXPERIMENTS

1. Measurement of displacement by LVDT.
2. Measurement of speed by contact and non contact measurement
3. Measurement of vibration by vibration meter.
4. Study of optical transducer trainer and temperature transducer trainers.
5. Programming examples using micro processor 8085 & 8031
6. Kinematic analysis and verification of2 DOF RR Configuration robot
7. Dimensional analysis and synthesis of one degree of freedom robot
8. Modeling and simulation of 3 DOF triglide parallel manipulator
9. Experimental verification of stepper motor rotational angle
10. Angular rotation of moving platform of triglide parallel manipulator.

TOTAL: 45 PERIODS

PR9408 COMPREHENSION L T P C
0 0 2 1

The objective of this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality. The students work in groups and solve a variety of problems given to them. The problems given to the students should be of real like industrial problems selected by a group of faculty members of the concerned department. A minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

TOTAL: 30 PERIODS

PR9451 **PROJECT WORK** **L T P C**
0 0 12 6

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

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

PR9021 **PRECISION ENGINEERING** **L T P C**
3 0 0 3

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 CONCEPT OF ACCURACY AND OF MACHINE TOOLS: 10
Part Accuracy – errors, accuracy of machine tools – spindle accuracy – displacement accuracy – errors due to numerical interpolation - definition of accuracy of NOC system – errors in the NC machines – feed stiffness – zero stability.

UNIT II STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING 9
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 9
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 8
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

TEXT BOOK

1. Murthy.R.L."Precision Engineering in Manufacturing", New Age International Pvt. Limited.
2. Norio Tanigughi, "Nano Technology", Oxford University Press, 1996.

REFERENCES

1. Stephen A.Campbell, "The Science and Engineering of Micro electronic Fabrication", Oxford University Press, 1996.
2. Randy Frank, "Understanding Smart Sensors", Artech. House, Boston, 1996.

PR9022 FUZZY LOGIC AND NEURAL NETWORKS L T P C
3 0 0 3

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 – Mutiobjective Decision making - Fuzzy Classification – c-Means Clustering -Fuzzy pattern Recognition – Image processing applications – Syntactic Recognition - Fuzzy optimization – Various Fuzzy measures.

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 – Various 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 – Kohenen 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 BOOK

1. S. Rajasekaran, G.A. Vijayalakshimi 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. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall, 1992.
5. Gen, M. and R.Cheng,” Genetic Algorithm and Engineering Design”, John Wiley, 1997.

PR9023 INSTRUMENTATION AND CONTROL L T P C
3 0 0 3

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 & 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 BOOK

1. B.C.Nakra, K.K.choudry,"Instrumentation, Measurement and analysis", Tata McGraw Hill, 2002.
2. 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.Sawhney,"electrical and electronic measurement and instrumentation,"Dhanpat rai&Co., 2003.
3. Benjamin C.Kuo,"Automatic control systems", 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

PR9024 SURFACE ENGINEERING LT P C
3 0 0 3

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 processes – alkaline cleaning – emulsion cleaning – ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and bulling shot peening – classification of surface engineering processes.

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS 10

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

UNIT III HOT DIP COATING AND DIFFUSION COATINGS 10

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

UNIT IV NON-METALLIC COATING OXIDE AND COVERSION COATINGS 9

Plating coating – Lacquers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, 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 BOOK

1. STAN GRAINGER engineering coatings – design and application Jaico publishing House, 1994.

REFERENCES

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

PR9025 DESIGN OF MACHINE TOOL STRUCTURES L T P C
3 0 0 3

UNIT I INTRODUCTION 10

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 8

Dynamic system – Elastic system – working processes – vibration in machine tools – self ex cited 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 BOOK

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.

PR9026 **PRODUCTION MANAGEMENT** **L T P C**
3 0 0 3

AIM:
To introduce the concepts of Production Management to the students with case studies.

OBJECTIVES:
To introduce the various techniques of Production Management and to make students to apply these for modeling and solving many engineering situations.

UNIT I MATERIAL AND INVENTORY MANAGEMENT 7
Independent demand inventory Models – Fixed order system – Basic EOQ Model – EBQ Model – Quantity discount models – Dependent demand inventory models – MRP – EOQ under constraints.

UNIT II FORECASTING AND AGGREGATE PLANNING 8
Forecasting - types – Methods – Minimizing forecasting errors – selection of forecasting methods – Aggregate planning strategies and costs – Tabulation method – Linear programming method.

UNIT III SCHEDULING AND PROJECT MANAGEMENT 10
Johnson's algorithm for job sequencing for n job through 2 machines, 3 machines and m machines – scheduling analysis – PERT – CPM – Drawing the network – Floats – Critical path – Resource leveling techniques.

UNIT IV PLANT LAYOUT AND WORK STUDY 10
Facility location decisions – Facility layout decisions – Types of Production – Materials handling, techniques – Line balancing – Method study – work measurements.

UNIT V APPLICATION OF O.R. TECHNIQUES TO MANAGEMENT 10
Queuing theory – Single channel models – Multi channel models – Monte carto simulation – Replacement models – Replacement of items that deteriorate with time – Replacement of items that fail suddenly.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.Kesavan, C.Elanchezian and T.Sundar Selwyn – Engineering Management, Eswar Press – 2005.
2. R.Paneerselvam – Production and Operation Management – Prentice Hall of India, 2003.
3. R.Kesavan, C.Elanchezian and B.Vijayramnath – Production Planning and Control – Anuratha Publication Co. Ltd. Chennai.

PR9027 **ERGONOMICS** **L T P C**
3 0 0 3

UNIT I INTRODUCTION **9**

Inter disciplinary nature of ergonomics – modern ergonomics – human performance – Information processing – Factors affecting Human performance – physical workload and energy expenditure.

UNIT II WORK SPACE DESIGN **9**

Anthropometry – Workspace design for standing and seated workers – Arrangements of components within a physical space – Interpersonal aspect of workplace design.

UNIT III DESIGN OF EQUIPMENT **9**

Ergonomic factors to be considered, design of displays and controls – design for maintainability – heat stresses – manual lifting.

UNIT IV DESIGN FOR ENVIRONMENT **9**

Illumination – Climate – Noise – Vibration – Heat, cold – Lighting design considerations – Effect of noise on task performance.

UNIT V RECENT ADVANCES AND TRENDS **9**

Legislative trends – Trends in work system Design – occupational diseases – Application of Ergonomics in automobiles.

TOTAL: 45 PERIODS

TEXT BOOK

1. Martin Helander, A guide to Ergonomics of Manufacturing, TMH, 1996.

REFERENCES

1. Bridger, R.S.Introduction to Ergonomics, McGraw Hill, 1995.
2. Mccormic, J.Human factors in Engineering and Desing, McGraw Hill, 1992.
3. Wilson, J.R.Corlect EN, Evaluation of Human work, A. practical Ergonomics methodology, Taylor and Frances, 1990.
4. Shackel, B.Richardson .S, Human Factors for Information usability, Cambridge University, Cambridge University Press, 1991.

PR9028 PROCESSING OF POLYMER & 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 – Pultrusion – 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. Sol gel 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 materials”, Springer – Verlag, 2002.
3. Kenneth G.Budinski & Michael K.Budinski, “Engineering Materials”,Prentice Hall of India Pvt. Ltd., 4th Indian Reprint, 2002.

REFERENCES

1. T.W.Clyne 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.

PR9029 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

UNIT I FINANCIAL ACCOUNTING 12

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

UNIT II PROFIT VOLUME ANALYSIS 10

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

UNIT III WORKING CAPITAL MANAGEMENT 8

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

UNIT IV CAPITAL BUDGETING 7

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

UNIT V ENGINEERING ECONOMICS 8

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

TOTAL: 45 PERIODS

TEXT BOOK

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

REFERENCES

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

PR9030 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.

UNIT III STORES MANAGEMENT 8

Store function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – codification – Inventory pricing stores management – safety – warehousing.

UNIT IV MATERIALS PLANNING 12

Forecasting – ABC analysis – Materials requirements planning – systems – Quantity – periodic - Deterministic and probabilistic models – Aggregate planning – JIT.

UNIT V INVENTORY MANAGEMENT – QUANTITY DISCOUNT EOQ MODEL 11

Finite Production – Lot size under constraints – Application of O.R. Techniques in Materials Management.

TOTAL: 45 PERIODS

TEXT BOOK

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Texland 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.

PR9031 NON DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

UNIT I INTRODUCTION 5

NDT And It's Importance - NDT vs Destructive Testing - Visual Examination - Basic Principles,Optical Aids Used And Applications.

UNIT II LIQUID PENETRANT AND MAGNETIC PARTICLE TESTING 9

Liquid Penetrant - Principles , Procedure For Penetrant Testing ,Penetrant Testing Methods , Sensitivity ,Applications And Limitations - Standards.

Magnetic Particle Testing – Principle , Magnetizing Techniques , Procedures , Equipments , Sensitivity , Applications & Limitation - Standards

UNIT III EDDY CURRENT AND ULTRASONIC TESTING 9

Eddy Current: Principles, Instrumentation, Techniques, Sensitivity, Advanced Test Methods, Applications& Limitations – Standards.

Ultrasonic Testing: Properties of Sound Beam , Transducers , Inspection Methods , Techniques For Normal And Angle Beam Inspection , Flaw Characterization - Equipments , Modes of Display – A –Scan , B- Scan & C-Scan - Immersion Testing - Application , Advantages and Limitations – Standards

UNIT IV RADIOGRAPHY 10

Radiography – Electromagnetic Radiation Sources – X - ray Production & Gamma Ray Sources - Properties .Radiation – Attenuation & Effects In Film - Radio Graphic Imaging - Inspection Techniques - Applications And Limitations –Safety in Industrial Radiography - Neuron Radiography –Standards.

UNIT V OTHER TECHNIQUES & SELECTION OF NDT METHODS: 12

Other Techniques: Acoustic Emission Testing - Principle, Techniques, Instrumentations, Applications and Standards. Thermography - Principles, Equipments Techniques, Applications and Standards. Leak Testing - Methods,Detection & Standards.

Selection: Defects In Material - Selection of NDT and Instrumentation - Some Case Studies .

TOTAL: 45 PERIODS

TEXT BOOK

1. Baldev Raj , T. Jayakumar and M.Thavasimuthu , "Practical Non – Destructive Testing", Narosa Publishing House , II – Edition , 2002 .

REFERENCES

1. Baldev Raj & B.Venkataraman , "Practical Radiology " , Narosa Publishing House 2004 .
2. Peter J.Shull , " Non – Destructive Evaluation - Theory , Techniques and Applications " , Marcel Dekker , Inc ., Newyork ,USA , 2002 .
3. Birchan . D , " Non – Destructive Testing " , Oxford , London , 1975.
4. Hal , " Non – Destructive Testing Manual " , Hindustan Aeronautics Limited , Bangalore , 1981
5. Barry Hill & Vernon John , " Non - Destructive Testing " , Mc. Millan , 1988 .
6. Metals Hand Book , Vol.11 , Non destructive testing and Quality Control ,8 th ed., ASM , 1976 .

PR 9032 SIMULATION OF MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVE

- To introduce the concepts of simulation and to apply them for manufacturing system

UNIT I INTRODUCTION 8

Basic concept of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – system modeling – types of modeling.

UNIT II RANDOM NUMBERS 10

Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – data collection and reduction – time flow mechanical – key variables - logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 7

Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 10

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems, (Students may be asked to prepare and present the case studies)

TOTAL: 45 PERIODS

TEXT BOOKS

1. Jerry Banks and John S.Carson, “Discrete event system simulation”, Prentice Hall 1991

REFERENCES

1. John H.Mize and J.Grady Cox, “Essential of simulation” – Prentice hall 1989.
2. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
3. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
4. Averill M.Law and W.David Kelton, “Simulation Modelling and analysis”, McGraw Hill International Editions, 1991
5. Shannon R.E., “System simulation”, Prentice Hall 1993.

PR9033 RELIABILITY ENGINEERING L T P C
3 0 0 3

UNIT I RELIABILITY CONCEPTS 6

Reliability definition – Reliability function – Graphical representation – a priori, a posteriori probabilities of survival. Component mortality – Mortality curve – Useful life – Reliability mathematics.

UNIT II FAILURE DATA MODELING 13

Failure data requirements – Measures of reliability: Failure rate, MTBF, MTTF – Median time to failure – Comparison of measures of central tendency – Design life – Performance parameters using histogram – Survival curves – Failure time distributions Variable failure rates – Ranking of data – Probability plotting: Binomial, Exponential, Weibull hazard plotting – Goodness of fit: Chi square test – Kolmogorov Smirnov test – Confidence intervals.

UNIT III RELIABILITY PREDICTION AND MODELING 13

Series – parallel configurations – Redundant systems – Standby systems – K out of n redundancy – Reliability of complex systems: RBD approach – Baye's decomposition method – Cut and tie sets – Fault tree analysis – Markov model – Software reliability prediction and measurement.

UNIT IV RELIABILITY MANAGEMENT 8

Reliability in design – limitations – Reliability life testing – Reliability growth monitoring – Reliability allocation – Reliability Centered Maintenance (RCM) – Replacement models: Items that deteriorate with time – Items which fail completely – Economic life of asset – Spares planning – System availability – Restorability demonstration.

UNIT I RISK ASSESSMENT 5

Perception of risk and ALARP – Measurement of risk – Hazard identification: HAZOP, HAZID – FMEA – Probabilistic Risk Assessment. (PRA).

TOTAL: 45 PERIODS

REFERENCES:

1. An introduction to, "Reliability and Maintainability Engineering"- Charles E.Ebeling, TMH, 2000.
2. Practical Reliability Engineering – Patrick D.T.O'Corner John Wiley & Sons Ltd., 2003.
3. "Reliability for Technology, Engineering and Management", Paul Kales, Prentice Hall, New Jersey, 1998.

PR9034 MACHINE TOOL CONTROL & CONDITION MONITORING L T P C
3 0 0 3

OBJECTIVE:

- To understand the control system of machine tools and its applications
- 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.

PR9035 **MINI PROJECT** **L T P C**
0 0 6 3

OBJECTIVES:

- The students in batches (not exceeding three in a batch) have to take up a project in the area of manufacturing engineering.
- Each batch is guided by a faculty member. The students have to select a suitable problem, design, prepare the drawings, produce the components, assemble and commission the project.
- The students have to prepare and present a detailed project report at the end of the VIII Semester

The evaluation will be made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department

PR9036 **MACHINE VISION** **L T P C**
3 0 0 3

OBJECTIVE:

- To understand the principle, importance and application of machine vision system in Manufacturing and measurement

UNIT I INTRODUCTION TO MACHINE VISION 6

Machine Vision use of machine vision – tasks for a vision system – relation to other fields – place of vision in CIM.

UNIT II IMAGE ACQUISITION AND CONVERSION 6

Colour systems – light sources – lighting techniques – image formation by lensing – image scanning – television cameras – sensors, charge coupled devices – camera and system interface – frame buffers and frame grabbers – digital and smart camers.

UNITIII IMAGE PROCESSING DECISION MAKING 12

Processing of binary images – thresholding, geometrical properties, topological properties – processing of gray scale images statistical operations, spatial operations, segmentation edge detection, morphological operations – image analysis – factors extraction – decision making.

UNIT IV PATTERN RECOGNITION 9

Fundamentals – parametric classifiers – nonparametric, classifiers nearest neighbor CART, neural networks, generic classifiers.

UNIT V MACHINE VISION APPLICATIONS 12

Applications in user industries automotive, semiconductor, electronic manufacturing, printing industries etc. – generic applications founding manufacturing metrology, inspection assembly verification – application analysis and implementation.

TOTAL: 45 PERIODS

REFERENCES

1. Milan sonka, Vaclav hlavac, roger boyie, image processing, analysis and machine vision publisher, 1995
2. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973
3. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992
4. Nella zuech, 'Understanding & applying machine vision Marceldekker Inc. 2000.

PR9037 ADVANCES IN OPERATION RESEARCH L T P C
3 0 0 3

OBJECTIVE:

- 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. Guptha 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

PR9038 MODERN MANUFACTURING PROCESS L T P C
3 0 0 3

UNIT I MECHANICAL ENERGY BASED PROCESSES 8

Abrasive Jet Machining – Water Jet machining – Ultrasonic machining, (AJM, WJM and USM). Working Principle – equipments used – Process 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 PROCESSES 8

Electric Discharge Machining (EDM) – working principle – equipments – medium - Process Parameters – MRR – Electrode-Tool – Power circuits-Tool Wear – Dielectric – Flushing – Wire cut – EDM – Applications.

UNIT IV THERMAL ENERGY PROCESSES 10

Laser Beam machining (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM), Principle – Equipment – Types – Beam control techniques – Applications.

UNIT V RAPID PROTPTYPING 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).

PT9071 PACKAGING MATERIALS & TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:
- To study the fundamentals of packaging, manufacturing process, packaging materials and package testing.

UNIT I FUNDAMENTALS OF PACKAGING 6

Definition, functions of packaging, types and selection of package, Packaging hazards, interaction of package and contents, materials and machine interface, Environmental and recycling considerations - life cycle assessment

Package Design - Fundamentals, factors influencing design, stages in package development, graphic design, Structural design – simulation softwares

UNIT II PACKAGING MATERIALS 11

Major Plastic packaging materials viz. Polyolefins, Polystyrene, Polyvinylchloride, Polyesters, Polyamides (Nylons), Polycarbonate and newer materials such as High Nitrile Polymers, Polyethylene Napthalate (PEN), Nanomaterials, biodegradable materials – properties and applications, recycling; Wood, Paper, Textile, Glass, Metals - Tin, Steel, aluminum, Labelling materials, Cushioning Materials – properties and areas of application.

UNIT III CONVERSION TECHNOLOGY 12

Extrusion – Blown film, cast film, sheet, multilayer film & sheet, Lamination, Injection moulding, Blow moulding, Thermoforming; Cartoning Machinery, Bottling, Can former, Form Fill and Seal machines, Corrugated box manufacturing machineries, Drums – types of drums, moulded pulp containers, Closures, Application of Robotics in packaging.

Surface treatment for printing, Printing processes – offset, flexo, gravure and pad printing

UNIT IV SPECIALITY PACKAGING 9

Aerosol packaging, Shrink and Stretch wrapping, Blister packaging, Anti-static packaging, Aseptic packaging, Active packaging, Modified Atmospheric Packaging, Ovenable package; Cosmetic packaging, Hardware packaging, Textile packaging, Food packaging; Child resistant and Health care packaging, Export packaging, Lidding, RFID in packaging.

UNIT V TESTING 7

Package Testing – Drop test, Impact test, Vibration Test, Stacking and Compression test, Packaging Materials Testing: Mechanical – Tensile, tear burst, impact, compression test, Elongation, barrier properties - WVTR test, Adhesion test, Optical – Gloss, haze and clarity; Chemical Resistance test – solvents and chemicals, solubility test, burning test, solvent retention; Hardness and corrosion test for metals; Clarity and brittleness test for glass

TOTAL: 45 PERIODS

TEXT BOOKS

1. Aaron L.Brody & Kenneth S.Marsh, "Encyclopedia of Packaging Technology", John Wiley Interscience Publication, II Edition, 1997.
2. F.A. Paine, "Fundamentals of Packaging", Brookside Press Ltd., London, 1990.
3. A.S.Athayle, "Plastics in Flexible Packaging", Multi-tech Publishing Co., First Edition, 1992.

REFERENCES

1. Mark J.Kirwar, "Paper and Paperboard Packaging Technology", Blackwell Publishing, 2005
2. "Handbook of Package Design Research", Water stem Wiley Intrascience, 1981.
3. Paine, "Packaging Development", PIRA International, 1990.
4. Arthur Hirsch, "Flexible Food Packaging", Van Nostor and Reinhold, New York, 1991.
5. E.P.Danger, "Selecting Colour for Packaging", Grover Technical Press, 1987.
6. Susan E.M.Salke & et al, Plastics Packaging, Hansar, 2nd edition 2004.
7. Bill Stewart, "Packaging Design Strategies", Pira International Ltd, 2nd Edition 2004.
8. Gunilla Johnson, "Corrugated Board Packaging", PIRA International, 1993

GE9021 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

AIM

To sensitize the engineering students on blending both technical and ethical responsibilities.

OBJECTIVES

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

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 Analysis – Reducing Risk – The Government Regulator's Approach to Risk - l Case Studies Chernobyl 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)

GE9022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOK

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia,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, 3rd 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.

GE9023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

AIM

To make the students understand the importance, relevance and potentialities of this emerging field of study.

OBJECTIVES

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the importance role of physics, chemistry, biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

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.